Enforcement of Labor Regulation and Informality

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Abstract

Enforcement of labor regulations in the formal sector may drive workers to informality because they increase the costs of formal labor. But better compliance with mandated benefits makes it attractive to be a formal employee. We show that, in locations with frequent inspections workers pay for mandated benefits by receiving lower wages. Wage rigidity prevents downward adjustment at the bottom of the wage distribution. As a result, lower paid formal sector jobs become attractive to some informal workers, inducing them to want to move to the formal sector.

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1. Introduction

There is weak compliance with labor regulations in many developing countries. One of the most visible manifestations of this problem is the existence of large informal sectors, which are often argued to be harmful for workers, and detrimental to growth. In this setting, one view of labor inspections is that they promote formality by detecting and punishing informal employment.

In practice, because of high costs of enforcement and scarce resources, labor inspectors often focus on formal firms since they are easier to find than informal firms. Formal firms violate several aspects of labor law, but they are less likely to hire informal workers than informal firms. Therefore, labor inspectors generally miss the main source of informal employment.

In this context, it is possible that frequent targeting of formal firms by labor inspectors could drive workers to the informal sector by causing an increase in the costs of formal employment. This line of reasoning, however, neglects that labor inspectors may be enforcing compliance with mandated benefits which are highly valued by workers, and potentially increase the attractiveness of the formal sector. In this alternative scenario, the response of workers depends on their valuation of the benefits being enforced.

We study the impact of labor inspections on labor market outcomes in Brazil, by exploring municipal variation in the level of enforcement in 2000. Earlier work by sociologists Cardoso and Lage (2007) argues that labor inspections mainly target compliance with job severance contributions by formal firms, and our data is consistent with their argument.

Our empirical results show that in response to a rise in labor inspections we observe an increase in formal employment, a decrease in informal employment, a rise in non-employment, a

decline in wages at the top of the formal wage distribution, and an increase in informal wages. All of the movement from the informal to the formal sector is among the self-employed.[2]

Our argument is that in the early 1990s labor inspectors started enforcing compliance with mandated benefits, namely contributions in advance to the job severance fund, and job severance payments upon dismissal. This occurred because formal firms were much easier to find than informal firms and there was low compliance with job severance contributions. In addition, revenues from advanced contributions could be counted as increases in government revenue. This contributed to an improvement in public accounts (at least in the short run) and governments had great interest in their collection. Job severance benefits were also highly valued by workers, who could access part of the severance entitlement even if they were not dismissed.

As a result of increased enforcement, formal workers pay for more generous mandated benefits by receiving lower wages. The value that workers place on these benefits is potentially higher than their cost to employers because they are untaxed. In addition, wage rigidity (e.g., through minimum wages) prevents downward adjustment at the bottom of the wage distribution. This causes formal sector jobs at the bottom of the wage distribution, to become more attractive to informal workers, leading them to switch to the formal sector. In the process, wages in the informal sector adjust upwards. Unemployment may increase if the minimum wage makes it harder to find a job in the formal sector. Together with an increase in informal wages, this rise in (formal) unemployment also helps to clear the market (as in Harris and Todaro, 1970).

The main empirical challenge in our analysis comes from the fact that enforcement is not randomly distributed across cities. On one end, enforcement may be stronger in cities where reports of labor violations are more frequent. On the other end, enforcement may be stronger in

[2] Self-employed workers do not necessarily have to be informal. However, in Brazil, only 15% of self-employed workers pay social security contributions. It is therefore safe to assume that almost all of the self-employed effectively operate in the informal sector.

cities with better institutions. In order to proceed with our analysis it is essential to investigate the main determinants of enforcement.

The technology of enforcement is relatively simple. Labor inspectors are assigned to enforcement offices located in cities across Brazil. They choose which firms to visit, essentially based on a list of anonymous reports of violations of the labor code. They travel by car from their base city to the city where the inspected firm is located. This suggests that there are two important inputs to this technology: the number of inspectors in each enforcement office, and the distance they need to travel from the base to each particular city. Cities located at a farther distance from the nearest enforcement office are less likely to receive a visit from the labor inspector. Moreover, in locations where there is an abundance of labor inspectors, distance to the enforcement office is a less important constraint.

Our empirical work compares the differential impact of distance to the nearest enforcement office on labor market outcomes in each city, across states with different numbers of labor inspectors. Identification is based on the idea that travel time is less of a constraint in locations with greater availability of inspectors. Moreover, we control for labor market outcomes in an earlier period, when enforcement was a less important activity. Therefore, we are able to check how exposure to different levels of enforcement (induced by variation in distance and inspectors in the state) produced changes in labor markets that looked similar before enforcement ever became important.[3] Our data includes information on labor market outcomes in each city in 2000 and 1980, measures of enforcement, distance from each city to the nearest enforcement office, the number of inspectors working in each state, and several other variables such as distance to the state capital, measures of transportation costs, and city and state characteristics.

[3]A similar identification procedure is used by Rajan and Zingales (1998) who examine the effect of financial dependence on growth, Goldberg and Pavnick (2003), who study the effect of trade reform on informality, and Verhoogen (2008), who studies the impact of trade incentives on quality upgrading.

We find that an increase in the level of enforcement in a city leads to an increase in the share of the population in formal employment, an increase in non-employment, a decrease in self-employment, a reduction in formal wages, and an increase in earnings of those who are self-employed (most of whom are informal workers). There is little change in the employment and wages of those who are informal employees. Our analysis shows that even if labor market reform has a direct impact only in the formal sector, it will strongly affect workers outside of the formal sector because of linkages across markets. In addition, we discuss potential problems with our analysis, and present evidence that they are unlikely to be important.

This paper builds on and contributes to a long literature. Our theoretical framework draws on Harris and Todaro (1970), Fields (1975, 2005), MacDonald and Solow (1985), Maloney (2004), and Levy (2008).[4] Although labor regulation is strict in Brazil, there is surprisingly large wage and employment flexibility (e.g., Barros and Mendonca, 1996). The reason for this may be low enforcement. When interpreting our findings we think of a simple static model of the labor market with minimal rigidities, except for a minimum wage. All restrictions to firing and hiring enter the labor demand function implicitly as costs of labor. [5]

Modern surveys of the role of labor market institutions include Layard and Nickell (1999), or Kugler (2007), among many others. The increasing availability of micro data led to the emergence of several studies examining the effect of labor market regulations in developing

[4] See also Harberger (1962), Bulow and Summers (1986), Acemoglu (2001), Albrecht, Navarro and Vroman (2006). Several other papers try to empirically distinguish segmented and non-segmented models of the labor market such as: Dickens and Lang (1985), Heckman and Hotz (1986), Maloney (1999) or Filho, Mendes and Almeida (2004).

[5] There are several recent other contributions to the literature on informality. They include work by Schneider and Enste (2000), Friedman, Johnson, Kaufmann, and Zoido-Lobaton (2000), Amaral and Quintin (2005), Galiani and Weischelbaum (2007), Boeri and Garibaldi (2006), Loayza, Oviedo and Serven (2005), de Paula and Scheinkman (2006), Bosch, Goni and Maloney (2007), and World Bank (2007). Especially related to us are studies on informality and inequality as Fields (1979, 2005), or Bourguignon (1990).

countries.[6] Two papers are especially close to ours. Besley and Burgess (2004) explore within country and time series variation in labor reforms in India to study the effect of labor regulations on productivity, investment, employment and poverty. Marrufo (2003) examines the social security reform in Mexico. This is one of the few papers that considers labor market policy in a multi-sector labor market (using a Harberger model with two sectors and worker heterogeneity).

Finally, we relate to the large literature on the labor market effects of mandated benefits (Summers, 1989, Lazear, 1990), both in the U.S. (e.g., Gruber, 1994) and in developing countries (e.g., Gruber, 1994, 1997, Kugler, 2005, MacIssac and Rama, 1997). In contrast to much of this literature, our model allows the informal sector to respond to changes in mandated benefits.

The next section of the paper provides background information on the Brazilian labor market, its institutions, and the structure of the enforcement process. Section 3 describes the data. Section 4 explains the empirical strategy. Section 5 shows the empirical results. Section 6 presents a simple theoretical framework for interpreting our findings and Section 7 concludes.

2. Labor Market Regulation and Enforcement in Brazil

2.1 Labor Regulations

On paper, Brazil has one of the least flexible labor markets in the world. The law establishes that all employees must have a work permit where the employment history of the worker is registered (*carteira de trabalho*). This permit entitles the worker to several benefits, such as a retirement pension, unemployment insurance, and severance payments. The labor code is largely written into the Brazilian constitution, which makes any amendments very difficult. The constitution of 1988 introduced several changes to the labor code, which increased the degree of worker's

[6] See, for example, Kugler (1999, 2001, 2004), Eslava, Haltiwanger, Kugler and Kugler (2006), Ahsan and Pages (2007), Petrin and Sivadasan (2006), or the studies in Heckman and Pages (2004).

protection (e.g., Barros and Corseuil, 2001). For example, the law establishes a maximum working period of 44 hours a week, a maximum period for continuous shift work of 6 hours, a minimum overtime pay of 1.5 times the normal hourly wage, paid leave of at least 4/3 of the normal wage and a paid maternity leave of 120 days. In addition, the employer must contribute monthly to social security and to a job security fund (FGTS). The FGTS is essentially a severance pay individual account. It accumulates for as long as the worker remains employed with the firm. The employer makes monthly contributions of 8% of the employee's current wage to the fund (10% from 2001 onwards). Cardoso and Lage (2004) estimate that for a worker to receive a net wage of Reais $100, the employer must disburse approximately Reais $165.

Firing a worker in Brazil is not significantly more difficult than firing a worker in other Latin American countries, although (on paper) it is more costly. Employers must give advance notice to workers and, in the interim period, workers are granted two hours a day to search for a job. The interim period is never smaller than one month and recently it became proportional to workers' tenure. During this period, employers cannot change the worker's wage. This implies that approximately 25% of paid hours are not worked. On top of that, if a dismissal induces a drop in motivation, the overall decline in production is probably above 25% (Barros and Corseuil, 2001). Workers who are fired without cause have the right to receive compensation paid by the employer, over and above what was accumulated in the worker's job security fund. In particular, the law establishes that a penalty equal to 40% of the fund accumulated during the worker’s tenure with the firm needs to be paid to the worker. Therefore, dismissal costs increase with the duration of the work contract. One obvious perverse effect of such high severance pay is that several workers force their dismissal, potentially increasing turnover rates, and increasing the firm’s costs (e.g., Neri, 2002).

It is important to highlight that severance payments are not subject to income taxation in Brazil (unlike most countries). Therefore, workers value one Real of FGTS more highly than one Real of gross salary. Moreover, firms pay taxes on profits, which can add up to more than 30%. As a result, the cost of FGTS to the firm is much smaller than the value of FGTS to the worker.[7] This has strong implications for the role of enforcement, which we explore below.

2.2. Enforcement of Labor Regulation

Firms weight the costs and benefits of complying with strict labor regulation. They may decide to hire informally or to hire formal workers without complying fully with specific features of the labor code (e.g., avoid the provision of mandatory health and security conditions, or avoid payments to social security). The expected cost of evading the law is a function of the probability of being caught and of the monetary value of the penalties (fines and loss of reputation). In turn, the probability of being caught depends on the firm's characteristics (such as size and legal status)[8] and on the degree of enforcement of regulation in the city where the firm is located.

The Ministry of Labor is in charge of enforcing compliance with labor regulation in Brazil. Given the size of the country, enforcement is first decentralized at the state level (the state level labor office is called *delegacia*) and then at a local level, the subregion (the local labor office is called *subdelegacia*). A *subdelegacia* is located in a city, but its catchment area generally includes more than one city (or *municipio*). In each state, the *delegacia* is always located in the state capital and the number of *subdelegacias* within the state is a function of the size and economic importance of each region. For example, the state of Sao Paulo has 21

[7] Coordination between workers and firms may difficult even if there are gains. For example, firms may not be able to credibly commit *ex-ante* that they will contribute to FGTS and pay severance upon dismissal. Enforcement of these benefits could help solve this commitment problem.

[8] Cardoso and Lage (2007) argue that the integration of firms in international trade and the need to comply with international quality standards (e.g., ISO certificate) implicitly forces firms to comply with regulation. For example, it is often the case that firms who wish to export need to prove their compliance with labor regulations and cannot resort to any forms of child labor or slavery.

subdelegacias while other smaller states, like Acre or Amapa, only have one *subdelegacia*, which coincides with the *delegacia*.

Labor inspections were probably of little relevance during the 1970's and 1980's. The labor code was much less strict at the time, and the inflation of the 70s and hyperinflation of the 80s and early 90s contributed to an erosion of the nominal value of fines. However, labor inspections gained importance in the second half of the 90's. Labor regulation became much stricter after the 1988 Constitution, and inflation stabilized as well. Moreover, the strong government deficit in the mid 1990s lead the government to search for alternative ways to collect revenue, and labor inspectors started being used as tax collectors. Their main goal was to collect job security contributions, which helped reduce the size of the government deficit, at least in an accounting, sense (since they cannot be used directly by the government to fund its expenditure). It was probably only after this change that labor inspections gained prominence.

Inspectors are affiliated with a specific *subdelegacia* but, to deter corruption, they must periodically rotate across *subdelegacias* (Cardoso and Lage, 2007). In theory, an inspection can be triggered either by a random firm audit, or by a report (often anonymous) of non-compliance with the law. Workers, unions, the public prosecutor's office, or even the police can make reports. In practice, since the number of labor inspectors is low relatively to the number of non-compliance reports, most inspections are triggered by these anonymous reports.

Inspectors assess the compliance of each inspected firm with several dimensions of labor law (e.g., worker's formal registration, severance pay, minimum wage regulation, hours of work). Almost all of the targeted firms are formal firms because it is difficult to visit a firm that is not registered (an informal firm), since there are no records of its activity. As a result, a large fraction of informal employment is left out of the inspectors' reach. Inspectors face a

performance based pay scheme. In particular, up to 45% of their wage is tied to the efficiency of the overall enforcement system. Their monthly base wage is fairly competitive (between USD 2,490 and USD 3,289 in 2004).

When faced with violations of the labor code, inspectors must immediately notify the firm. The firm then has 10 days to present evidence in its defense. After that period, the process is re-examined by a different inspector from the one issuing the original fine, who deliberates on its fairness, and the result is reported to the head of the *subdelegacia*. If firms do not contest the fine and pay it within 10 days of their notification, there is a 50% discount on the amount of the fine. Alternatively, if firms file an appeal, they must deposit the total value of the penalty until a second decision has been reached. In practice, small and medium firms pay the fines early to take advantage of the discount. Larger firms, with their own legal departments, tend to refute the deliberations, and often avoid the payment of any fines. Fines can be either fixed, or indexed to firm size and profitability. For example, a firm is fined by Reais 446 for each worker that is found unregistered during an inspection. Depending on its size and profitability, if a firm does not comply with the mandatory contributions to the FGTS, then it can be fined an amount between Reais 16 and Reais 160 per employee.[9]

2.3. What Are Labor Inspectors Really Doing?

Although the number of inspectors was relatively low in the early 2000s, inspectors were able to reach a significant part of the total labor force in formal firms. In 2002, 304 thousand firms were visited by labor inspectors, reaching more than 19 million workers (Cardoso and Lage, 2007). Approximately 17% of these firms received a notification of non-compliance with some aspect of the law. Moreover, less than 3% of the workers in these firms were found to be

[9] Cardoso and Lage (2007) argue that the magnitude of the fines is quite reasonable to work as a deterrent to crime, and that the main problem is their enforcement.

informal and registered as a result. This is a small number given that 50% of employment in Brazil is informal. This likely reflects the fact that informal workers are concentrated in small and informal firms outside the reach of labor inspectors, but it may also suggest that, among the different types of violations of labor law, informality is not the main target of the inspections. [10] According to Cardoso and Lage (2007), the focus of labor inspectors is on the lack of payment of the job security fund (and health and safety conditions on the job).

If we study ILO reports on labor inspections and informality we learn that labor inspectors target mainly formal firms in most countries, precisely because they are easier to find than informal firms.[11] Berg (2010), from the ILO office in Brazil writes that "because of the way the system is structured, the majority of the workers that have been registered have been informal workers working in formal firms. They comprise approximately 2.2 percent of the total number of workers covered by labour inspection activities. Registering informal workers in formal firms is an important accomplishment and should not be downplayed, but as most of informality concerns informal workers working in unregistered firms, other approaches are also needed."[12]

The Ministry of Labor tries to apply uniform criteria for enforcing labor regulation throughout the country (e.g., by providing training and using similar software). In practice, however, this is very difficult to achieve because Brazil is a very large and diverse geographical area. Inspectors are also likely to be very heterogeneous. They have to travel different distances

[10] All violations are punishable with fines. Inspectors issue fines for the non-registration of workers, disobedience of the official work period or hours worked, non-compliance with the mandatory wage payments (including minimum wages), missing FGTS contributions or health and safety violations. But fines are inaccurate measures of enforcement for two reasons. First, fines require a violation of the law, and much enforcement may have a deterrent effect not translated into fines. Second, inspectors avoid issuing fines, and try first to negotiate with the firm in non-litigious ways (Cardoso and Lage, 2007).

[11] For example, in an ILO document Salter (1998) writes: "Since labour inspectors in developing countries are not well enough resourced even to inspect adequately and often enough the medium and large enterprises, they can rarely if ever turn their attention to the problems of informal sector workers." For a detailed review of labor inspections in Latin America see issue number 6 of the *Revista Latino-Americana de Derecho Social* (2008).

[12] In recent years there has been an attempt to directly tackle informality, at least in specific sectors, through the formation of small teams tied to a particular sector (see Berg, 2010 and Pires, 2008).

and face varying workloads depending on where they are located. This gives rise to substantial regional variation in the degree of enforcement across cities, which we will explore empirically.

3. Data

The paper explores several sources of data. First, we use administrative data on the enforcement of labor regulations (in 2002), collected (for our project) by the Department of Inspections at the Ministry of Labor. This data contains information on the number and location of regional labor offices, number of inspected firms, number of fines issued in each city, and number of inspectors per state (which we multiply by 10000 and then divide by the number of firms in the state). Our main measure of enforcement is the log inspections per firm in the city, which is computed with log number of inspections in the city multiplied by 100 (plus one) minus the log of the number of firms in the city. We also compute the proportion of workers inspected, with the log of the ratio of workers covered by inspections to total workers in the city. In this measure we cannot rule out double counting if the same worker is covered by multiple inspections to the same firm. Finally, we compute the number of inspectors per firm in the state, where we multiply total inspectors by 10,000 and divide by the number of firms in the state.

Second, we compute several city level labor market indicators using the 10% sample of the Brazilian Census in 2000. In particular, we compute the share of workers who are registered, unregistered, or self-employed, the share of non-employed (either unemployed or out of the labor force), and the distribution of wages for each type of worker. Table A1 reports the proportion of the working age adult population in each employment category. Registered and unregistered wage earners, self-employed, and non-employed individuals, together account for 87% of the

adult population in 2000.[13] In the empirical work we focus on these four groups. Informal employment and self-employment are considered two separate categories, as emphasized in the recent literature (Maloney, 2004, Fields, 2005, Bosch and Maloney, 2010). Most self-employed workers in Brazil can be considered informal. In 2002, there are 5,513 cities in Brazil.

Third, we use detailed information on other city level characteristics from two statistical and research institutes in Brazil - *Instituto de Pesquisa Economica Aplicada* (IPEA), and *Instituto Brasileiro de Geografia e Estatistica* (IBGE).[14] In particular, we collect information on the city's GDP per capita (2000), share of agriculture in GDP (2000), share of manufacturing in GDP (2000), share of services in GDP (2000), geographical city characteristics (including geographical area measured in squared kilometers, altitude, longitude and latitude), city transportation costs (1995), total federal transfers to each city (1990), different types of municipal expenditures (2000). The Ministry of Social Development provided information on whether a municipality participates in PETI, a program for the eradication of child labor (2000), and the number of recipients of *Bolsa Familia*, Brazil's largest cash transfer program in the municipality (2004). [15] The total number of firms (2002) in each city comes from the *Cadastro Central de Empresas*, collected by *IBGE*, which only includes formal firms. We also use past city level variables published by IPEA for the years 1970, 1980, and 1991, including city population and per capita income. Because some of the cities in 2000 did not exist in the 70's, 80's or even 1991, we use the more aggregate definition of minimum comparable unit (MCU),

[13] In the 2000 Census, each individual is classified into one of the following 10 categories: registered domestic worker, unregistered domestic workers, registered wage earner, unregistered wage earner, employer, self-employed, unpaid apprentice, unpaid employee (usually in family business), working for self-consumption, and without status (or not employed). Therefore, the remaining 13% of individuals in our data are formal and informal domestic employees (0.8% and 2.5% respectively), employers (1.5%), interns or apprentices (0.1%), unpaid employees (3.5%), and individuals working only for self-consumption (4.6%). These individuals are excluded from our analysis. These are small groups of the population and unlikely to be too much affected by changes in enforcement.
[14] These statistics are publically available at http://www.ipeadata.gov.br and http://www.sidra.ibge.gov.br/.
[15] The data we gathered for PETI is available since 1996 but data for Bolsa Familia is only available after 2004.

published by the IPEA, to obtain an estimate of these city variables in previous years.[16] For all cities in a given year, we know to which MCU each city was previously mapped into. Then, we computed the average value of each variable for each MCU (weighted by population size in each city), and assigned it to each city in the MCU.

Fourth, we use information on the institutional development of the city, published by IBGE.[17] These measures include an index of the access to justice in the city, an index of managerial capacity in the city and an index of political concentration in the city (based on a Hirshman-Herfindhal index of the shares of the political parties). The index of managerial capacity in the city measures the quality of local administration, and is used by the Ministry of Planning to monitor the administrative performance of cities. Access to justice measures the penetration of the rule of law, in particular the existence of courts or justice commissions in the city. We also consider state aggregates of these variables, by averaging across cities.

Fifth, we compute the distance and travel time (by car) between each city and the nearest *subdelegacia* in the state. The transportation of inspectors from the *subdelegacia* to each firm is made using ground transportation, usually car. Hence, the enforcement of labor regulation will be easier and less costly the closer a *subdelegacia* is from the city where the firm is located. We construct a measure of the accessibility of inspectors to firms by using the travel time from each city to the nearest *subdelegacia* within the state (minimum distance). Data on travel times and travel distances between any two Brazilian cities is available from one of the largest Brazilian auto insurance companies (BB), which collects very detailed information on distances across

[16] Of all cities in 2000, only 71% existed in 1970 (72% in 1980), while in 1991 this figure was 82%. A MCU is an area (set of cities) which is defined in such a way that can be compared over time.
[17] This data is used in Naritomi, Soares and Assuncao (2007), and was kindly made available by these authors.

cities.[18] When firms are located in cities that have a *subdelegacia* the measure assumes the value zero. We also construct the distance between each city and the state capital. In the remaining of the paper we focus on travel time as the most relevant measure of distance. A third measure of the remoteness of the city, or of its access to markets, is an index of transportation costs between each city and the nearest capital city taken from IPEA (1995).

Sixth, we use the 1980 Census to construct measures of the proportion of the population in each sector and the distribution of wages in each sector. Unfortunately, we cannot apply the same classification of individuals in both 1980 and 2000. In 2000 formal wage earners are employees and have a work permit, while in 1980 they are also employees, but we do not know whether they have a work permit. Instead, we check whether they pay social security. The reasoning is analogous for informal wage earners. For self-employed and non-employed individuals, the definitions are similar across the two Censuses.

Sample statistics for the main variables we use are presented in table 1. Both in 1980 and 2000 we account for close to 90% of the population using the four groups we consider: formal wage earners, informal wage earners, self-employed and non-employed. In the average city in Brazil, formal wage earners comprise of only 14% of the working age population (aged 23-65) in 2000, and about 30% of the labor force. Average wages are higher for formal wage earners than for informal wage earners. Earnings are even higher for the self-employed (in 2000 only), but so is the variance of earnings. There are about 3.2 inspections per 100 firms in a typical Brazilian city, with 22% of the workers being covered. This means that large firms are disproportionately

[18] This information is available online at www.bbseguroauto.com.br. When collecting information on distances, we faced two obstacles. First, we could not find information online for recently instituted cities. In these cases, we have located the nearest city (using maps) and used it instead of the original one to compute distances. Second, in most of the cities in Amazonas, maritime rather than the ground transportation is used for goods or persons. Hence, travel distance by car is meaningless for this state and therefore we have excluded it from the analysis. A related problem occurs in Para where roads exist, but the distances we computed are absurdly large when compare to distances using maritime transportation, and therefore we also exclude it from the analysis. Because of its size, Distrito Federal is integrated with Goias.

targeted for inspections. On average, there are 6 inspectors per 10,000 firms in the state. Cities are located 2 hours from the nearest enforcement offices and 4.5 hours from the state capital. In a typical city, individuals work mostly in the service sector.

Unfortunately, there are time discrepancies between the different variables that we could not overcome. Notably, enforcement is measured in 2002, while labor market outcomes are measured in 2000. Nevertheless, given that we rely mainly on cross-sectional variation (in distance and the availability of inspectors) to identify our main models, this is unlikely to be a central concern. And in our empirical work we make limited direct use of our measures of enforcement.[19] Furthermore, the level enforcement is likely to be highly correlated over time within the same city, and so are labor market outcomes. We explain below that our estimates should be interpreted as long run (perhaps even steady state) effects of enforcement on labor market outcomes. Under this interpretation, measuring enforcement in 2002 instead of in 2000 will not be a substantial problem.

4. Empirical Strategy

The goal of our empirical work is to understand whether enforcement of labor regulation at the city level, affects earnings and the employment of formal, informal, and self-employed workers. We explore two measures of enforcement: the logarithm of the number of inspections per firm in the city (computed as the number of visits by labor inspectors times 100 plus one, divided by the number of firms); and the logarithm of the proportion of workers targeted by inspections. The main obstacle we face is that enforcement is not randomly allocated across cities. This happens

[19] We have data on the number of inspectors per state for 2001 and 2002 and results are similar regardless of the one we use. Furthermore, even though 2002 was an election year in Brazil, this is unlikely to be relevant for our results. There is no systematic difference in enforcement activity in 2002 when compared to neighbouring years, when looking at aggregate data from the Ministry of Employment.

at least for two important reasons. First, enforcement may be stricter in cities where violations of labor law are more prevalent. This happens if inspections are triggered mainly through reports of illegal activity. Second, enforcement may be stricter in cities with more developed institutions. Intrinsic violations of the labor law, or better developed institutions, are probably correlated with labor market outcomes.

Finding a solution for this problem requires knowledge of the technology of enforcement. As explained above, labor inspectors are assigned to enforcement offices. They choose which firms to visit, essentially based on anonymous reports of violations of the labor code. They travel by car from their base city to the city where the inspected firm is located. This suggests that there are two important inputs to this enforcement technology: the number of inspectors in each enforcement office, and the travel distance from the base to each particular city. Cities located at a farther distance from the nearest enforcement office are less likely to receive a visit from the labor inspector. Moreover, this constraint will be more important in areas with low numbers of labor inspectors (relatively to their potential workload).

In our empirical work we compare the differential relationship between distance to the nearest enforcement office and labor market outcomes in each city, across states with different numbers of labor inspectors. We control for labor market outcomes in an earlier period, when enforcement was a less relevant activity. Therefore, we are able to check how exposure to different levels of enforcement produced changes in labor markets that looked similar before enforcement ever became important.[20]

[20] We would have liked to estimate a model where we directly compare the differential effect of distance on labor market outcomes across states in 2000 and 1980. However, the measures of labor market outcomes in the two census years are not exactly the same, and therefore we do not include them in the same regression. Furthermore, we do not know the location of full universe of enforcement offices in 1980 and the number of inspectors per state in that year. They are likely to be correlated with the values we observe in 2000, but are not the same. Therefore, we use data on labor market outcomes in 1980 only as control variables in our regressions.

We start by considering the following reduced form model:

$$Y_{cs} = \alpha + \psi D_{cs} + \eta_s + \beta\left(I_s * D_{cs}\right) + \delta XCity_{cs} + \sigma \widetilde{Y}^{1980}{}_{cs} + u_{cs}$$

where Y_{cs} is the outcome of interest in city c and state s, D_{cs} is distance to the nearest enforcement office from city c and state s, $XCity_{cs}$ is a vector of city controls, I_{cs} is the (number of labor inspectors (per firm) in the state, η_s is a state fixed effect, and u_{cs} is the residual. $\widetilde{Y}^{1980}{}_{cs}$ is our best approximation for the outcome of interest in 1980. β is the parameter of interest and measures the differential impact of distance to the enforcement office on labor market outcomes across states with different abundance of labor inspectors.

State fixed effects account for the fact that states with different numbers of inspectors per firm may also be different in other dimensions, while distance to the nearest enforcement office accounts for the non-random location of enforcement offices. Any remaining variation is given by the differential effect of distance across states with varying numbers of inspectors. We also control for several city level characteristics ($XCity_{cs}$): log income per capita and log population size in 1970, 1980 and 1991, city latitude, longitude, altitude and area. One could also be concerned that the number of state level labor inspectors is simply correlated with other state level characteristics ($XState_s$), like its level of development or institutional quality, which interacted with distance, could also affect outcomes of interest. Therefore we add to the model the interaction between distance to the enforcement office and other state characteristics: the log of the average of per capita GDP in the state between 1970 and 2000, and measures of city level institutions averaged at the state level (access to justice, governance and political concentration).

In addition, distance to the nearest enforcement office could potentially be capturing distance to relevant markets, which affects economic activity in the city (with consequences to labor market outcomes). This can interact with state characteristics. We therefore add to the

proposed reduced form the distance to the state capital ($DCapital_{cs}$) and an index of transportation costs to the nearest capital ($TCosts_{cs}$). Both are good measures of distance to important markets in the state. They enter the model on their own, interacted with the four state institutional variables, and interacted with the log of the number of inspectors per firm in the state. Therefore, in our final reduced form we will only explore the variation in distance to the nearest enforcement office remaining after we control for distance to large markets and urban centers. In section 6.4 we show that , with this empirical strategy, it is unlikely that we are confounding the effect of enforcement on labor markets with that of other variables.

In summary, the main empirical specification in the paper is:

$$\begin{aligned} Y_{cs} = \alpha &+ \beta(D_{cs} * I_s) + \psi_0 D_{cs} + \psi_1 (D_{cs})^2 + \phi(D_{cs} * XState_s) + \psi_2 DCapital_{cs} + \psi_3 (DCapital_{cs})^2 \\ &+ \psi_4 (DCapital_{cs} * I_s) + \tau(DCapital_{cs} * XState_j) + \psi_5 TCosts_{cs} + \psi_6 (TCosts_{cs})^2 \\ &+ \psi_7 (TCosts_{cs} * I_s) + \rho(TCosts_{cs} * XState_s) + \delta XCity_{cs} + \sigma \tilde{Y}^{1980}{}_{cs} + \eta_s + u_{cs} \end{aligned} \quad (1)$$

where all the variables are defined above. We estimate equation (1) with least squares after clustering the standard errors at the state level. The main outcomes of interest include the labor earnings and employment of formal, informal, and self-employed workers. We are also interested in the share of informal workers in the city, city poverty, inequality and the city unemployment. In addition we will also analyze how distance relates to our measures of enforcement. In particular, we will be interested in the estimates for the average marginal effect of distance on enforcement which is given by $\beta I_s + \psi_0 + 2 * \psi_1 D_{cs} + \phi XState_s$.

4.1. Graphical Illustration

Figures 1, 2 and 3 illustrate our procedure. For each state we run a regression of a measure of enforcement (the log of the number of labor inspections per 100 firms in the city) on distance to the nearest enforcement office (measured in hours of travel by car). Each circle in

Figure 1 represents a coefficient of one of these regressions, which is plotted against the log number of inspectors per 10,000 firms in the state. The size of the circle is the inverse of the standard error of the estimated coefficient. All coefficients are negative, indicating that cities located away from enforcement offices have low levels of enforcement. We then fit a regression of these estimated distance coefficients on the amount of inspectors per state. These coefficients are disproportionately negative in states with low endowments of inspectors. The slope of the regression line is positive and significant.[21]

If this is the case, and if enforcement has an impact on labor markets, we expect the relationship between distance and, for example, the share of informal workers or the formal-informal wage premium in the city, to be more pronounced in states with low numbers of inspectors.[22] Figures 2 and 3 show that this is true. In drawing Figure 2 we run a regression for each state of the share of informal workers in each city (in 2000) on the distance to the nearest enforcement office. The estimated coefficient is then regressed on the log number of inspectors per 10,000 firms in the state. Figure 3 replicates this exercise but looking instead that the formal-informal wage premium in the city in 2000. All regressions are weighted by the inverse of the estimated variance of the coefficient. Again, the slopes of the regression lines in the figures are

[21] Each state is represented by two letters as follows: Acre-AC, Alagoas-AL, Amapa-AP, Bahia-BA, Ceara-CE, Espirito Santo-ES, Goias-GO, Maranhao-MA, Mato Grosso-MT, Mato Grosso do Sul-MS, Minas Gerais-MG, Paraiba-PB, Parana-PR, Pernambuco-PE, Piaui-PI, Rio de Janeiro-RJ, Rio Grande do Norte-RN, Rio Grande do Sul-RS, Rondonia-RO, Roraima-RR, Santa Catarina-SC, Sao Paulo-SP, Sergipe-SE, Tocatins-TO. Amazonas and Para are excluded from the analysis because distance by road is not very meaningful in those states, and Distrito Federal is integrated with GO. Figures A1, A2 and A3 in the appendix use weights the number of cities in each state. The patterns are similar but the slope of the wage premium line is marginally insignificant (p-value = 0.11).

[22] When constructing these variables we consider three groups of the population: wage earners with a work permit, which we group in the formal sector; wage earners without a work permit, and self-employed workers, which we group in the informal sector. The degree of informality is the proportion of formal sector workers in each city, while the formal-informal wage premium is the difference in log average wages for each group in each city.

statistically different from zero. Both figures indicate that stronger enforcement leads to a reduction in informality and in the formal-informal wage premium.[23]

5. Empirical Findings

5.1. Does the Impact of Distance on Enforcement of Labor Regulation Vary Across States with Different Abundance of Labor Inspectors?

This section shows that distance to the nearest enforcement office and the number of inspectors per state are important determinants of the level of enforcement of labor regulation in a city. To establish this, we estimate equation (1) using as dependent variable two alternative measures of enforcement: the log of the number of inspections per 100 firms in the city and the log of the ratio of workers covered by inspections to total workers in the city (what we call the proportion of workers inspected, although we cannot rule out double counting if the same worker is covered by multiple inspections to the same firm).

Table 2 reports estimates of the average marginal effect of distance on enforcement (i.e., $\beta I_s + \psi_0 + 2 * \psi_1 D_{cs} + \phi XState_s$, evaluated at the mean of these variables), and the coefficient on the interaction of distance with the log number of inspectors per 10000 firms in the state. Each column corresponds to a different measure of enforcement. As expected, distance is strongly and negatively correlated with both measures of enforcement. More importantly, β is positive and significant. This implies that although the impact of distance on enforcement is negative, it is

[23] We explore variation in regulation across small geographic units (cities) within a country, whereas laws are usually implemented at the national level. A more subtle concern with our paper relates to migration of labor and capital across cities in response to increased enforcement. One extreme case where enforcement has no visible effect occurs when local labor demand and supply functions are perfectly elastic, even if aggregate demand and supply at the national level are inelastic. This cannot be the case in our data since we show strong effects of enforcement in local labor markets. There is an analogous discussion in the immigration debate (Card and DiNardo, 2000).

less negative in states where inspectors are abundant. With this in mind, we proceed to an analysis of labor market outcomes.

5.2. Wages and the Distribution of Employment across the Formal and Informal Sectors

This section investigates the effect of enforcement on the employment composition and earnings in each sector of the labor market. Table 3 reports the effect of enforcement on the share of the adult population in the city in each employment category, in 2000. The model in Panel A excludes 1980 controls ($\widetilde{Y}^{1980}{}_{cs}$), but they are included for Panel B. The specific 1980 variable included in each specification depends on the outcome of interest. For example, when the outcome is the proportion of individuals in the working age population working as formal wage earners, the 1980 control is the proportion of individuals who work as wage earners and pay social security. The reasoning is analogous for other types of individuals. In cities with stricter enforcement there is more formal employment, more non-employment, and less self-employment. There is no statistically significant effect of enforcement on the share of informal wage earners. Results are similar across panels.

In order to assess the magnitude of these coefficients we compare tables 2 and 3. The coefficient on the interaction in column (1) of table 2 is 0.212 (corresponding to roughly 20% of a standard deviation in the log number of inspections per firm in the city). This implies that a 21.2% increase in inspections causes a 1.6% decrease in the proportion of formal workers (from a mean of 14%), a 2.3% decrease in the proportion self-employed (with mean 19%), and a 1.7% increase in the proportion non-employed (with mean 37%).[24]

[24] Alternatively, one may look at table 3. If we change the number of inspectors per firm in the state from the 10th to the 90th percentile (from 3 to 10 inspectors per 10000 firms; in logs, from 1.13 to 2.31), the (presumably negative)

Table 4 analyzes the different percentiles of the wage distribution at the city level. Again, the two panels distinguish models with and without 1980 controls. For each percentile of the distribution of wages in the sector in 2000, we control for the corresponding percentile of the distribution of wages in the same sector in 1980. The results show that an increase in enforcement is associated with a decline in wages at the top of the formal wage distribution, an increase in wages among the self employed, and an increase in wages for highly paid informal wage earners. As a result, the differential between wages of formal and informal workers falls. These effects remain strong after controlling for the corresponding percentiles of the 1980 wage distribution in each sector.

To examine the magnitudes we compare again the coefficients in table 4 relative to the coefficient in column (1) of table 2. The estimates imply that a 21.2% increase in enforcement leads to 4.9% reduction in wages at the top of the formal wage distribution, a 3.6% increase in wages at the top of the informal employee wage distribution, and a roughly 6% increase across the self-employed earnings distribution.

Section 6 discusses a model of enforcement which is consistent with our empirical results. It assumes that labor inspectors target mainly formal firms and they enforce compliance with mandated benefits that are valued by workers. More standard views of the role of enforcement are at odds with the data. Suppose labor inspectors were mainly targeting informal employment, thereby increasing the probability that an informal employer is caught and punished, we would expect to see a decrease in the demand for informal workers, and a resulting decline in their wages. In order for labor markets to clear, formal employment would then rise and formal wages would fall. Finally, we would expect informal employees to be much more

impact of increasing distance by one hour on formal employment declines by 1.9% (=(2.31-1.13)*0.016), it increases by 2.7% for self employment, and it declines by 2% for non-employment.

affected than self-employed individuals, who generally do not have a stable employment relationship with a third party (being targeted by labor inspectors). Although we see a rise in formal employment and a decline in formal wages in the data, the other predictions of this simple model are at odds with the data.[25]

Alternatively, if labor inspections mainly operate by increasing labor costs of formal firms which have little value for employees, we expect to see a rise in informality which again we do not observe. Our finding that enforcement leads to an increase in non-employment can however be explained in this setting, since an increase in labor costs in the formal sector can drive workers to informality and to non-employment.

5.3. Enforcement and access to developed labor markets

An important concern with our main findings reported in tables 3 and 4, is whether we could be mistakenly capturing the differential impact of access to developed labor markets across states. Even though we control for several state and city level characteristics, one ultimately cannot guarantee that the only reason the effect of distance to the enforcement office on labor market outcomes varies with the number of inspectors available in the state is because it induces variation in enforcement of labor regulation across cities.

Notice that our specification is quite demanding. First, we could think that distance to the nearest enforcement office is capturing distance to important economic centers, since enforcement offices tend to locate in medium to large cities. However, we include in the

[25] Our empirical work ignores heterogeneity across firms. While it is plausible that inspectors target mainly formal firms, as resources increase they may increasingly shift their attention to informal firms. It is difficult to know how important this phenomenon is in practice. Berg (2010) shows that there is a severe scarcity of resources for inspections. For example, in 2008 Brazil had roughly one inspector per 30,000 workers, whereas the ILO standard for an industrializing economy is one inspector per 15,000 workers. In the appendix, table A2, we examined how the average number of workers covered per inspection varied with enforcement, by essentially running the model of equation (1) using as dependent variable the log number of workers per inspection (which only exists for cities with a positive number of inspections). We find that this quantity actually rises with the level of enforcement in the city, although the coefficient is not large. This result suggests that, at least as a first approximation, the phenomenon just described is empirically unimportant.

regression two good measures of distance to large economic centers: distance to the state capital, and an index of transportation costs to the state capital. We interact both variables with the log number of inspectors per firm in the state. Therefore, we are studying the role of distance to the enforcement office for cities located at the same distance and facing the same travel cost to the state capital. Notice also that we include state level dummies in the regressions, and we interact distance to the nearest enforcement office (and distance and transportation costs to the state capital) not only with the abundance of inspectors in the state, but also with other state level variables, namely average GDP per capita across 1970, 1980 and 2000, and measures of institutional quality in the state.

Second, we present results where we control for labor market characteristics in each city in 1980, a period where we argued that enforcement of labor market regulation was a much less relevant activity than in 2000. Controlling for these variables implies that we are estimating how differential levels of enforcement lead to a differential evolution in the labor market characteristics of cities that looked similar in the 80's.

It is also important to understand whether an economic model of enforcement would cause problems for our identification strategy. We develop one in Appendix B, which suggests that our assumptions on unobservables are not at odds with basic economic reasoning. Our procedure allows for unobservable city characteristics that are correlated with distance to the enforcement office, and also with labor market outcomes such as the level of informality in the city. For example, we expect enforcement offices to be located in large cities, with an existing set of functioning public institutions. One could also have unobservable state characteristics that are correlated with the number of inspectors per firm in the state, such as the underlying

propensity to have violations of the labor code in that state. The crucial thing is to rule out plausible interactions between the two.

Therefore, table 5 provides formal evidence that the interaction between the number of inspectors in the state and distance from each city to the nearest enforcement office is uncorrelated with several city level variables proxying institutional quality, different dimensions of public policy, and local economic conditions, which are likely to be correlated with the characteristics of the local labor market. We start by considering the role of state level policies to reduce regional inequality (associated with distance to large cities).[26] In particular, we consider whether the interaction between inspectors and distance is correlated with city level per capita GDP in 2000. If our empirical strategy is capturing other factors affecting local labor markets, such as distance to important economic centers, there should be a significant coefficient on this interaction when we estimate equation (1) using per capita GDP as dependent variable. Actually, it would be possible to observe a change in GDP per capita in the city even if our strategy was valid, because enforcement affected labor market outcomes which in turn could affect GDP. The findings in table 5 show that there is not a statically significant correlation. In fact, we think this is plausible since the effects of enforcement on labor market outcomes are likely not enough to cause substantial changes in the per capita GDP. In the following lines of table 5 we also check for effects on the industrial structure of the city and, reassuringly, we find none. Therefore, it is unlikely that our findings are being driven by some fundamental change in the economy, not caused but strongly correlated with enforcement, which would then substantially affect labor markets at the city level. The exact same argument applies to city size.

[26] One possibility is road construction. However, we measure distance to the nearest *subdelegacia* in travel time by car (not in miles) and the quality of the road infrastructure is already accounted for.

Another possible concern is whether states with more inspectors per firm tried to minimize the impact of distance to focal cities on the access to institutions. In this case our measure of enforcement could simply be capturing variation in the quality of other city institutions. In table 5 we proxy city level institutional quality using three indices: access to justice, governance, and political concentration. Reassuringly, the empirical findings do not show evidence that this is a significant source of concern.

When we look at city level inequality in social infrastructure, measured by the log number of households with access to piped water, sanitation, and electricity (normalized by the number of individuals in the city), we find no correlation between the interaction of distance and inspectors per state and access to water and sanitation. There is a small correlation with access to electricity, but it has the opposite sign to what one would expect if it were capturing confounding variation in other state policies. Moreover, there is no correlation with the log of current transfers from states to cities (drawn from state tax revenues) per capita.

Finally, we find that the interaction between the distance to the nearest enforcement office and the log of the number of inspectors per firm in the state does not predict the municipality participation in PETI, or the number of participants in *Bolsa Familia* in the city.

5.4 Robustness to Different Specifications

This section examines the robustness of our main results, reported in tables 3 and 4, to different specifications. First, in tables A3 and A4 of the appendix we replicate tables 3 and 4 using different controls. In specification (1) we simply control for distance to the nearest enforcement office and its square, distance to the nearest enforcement office interacted with the log number of inspectors per firm in the state, distance to the state capital and its square, distance to the state capital interacted with the log number of inspectors per firm in the state, and state

fixed effects. In the following specifications we add the following groups of variables cumulatively until: (2) interactions between the two distance variables mentioned above and the log of the average of per capita GDP in the state between 1970 and 2000, and measures of city level institutions averaged at the state level (access to justice, governance and political concentration); (3) city latitude, longitude, altitude and area; (4) log population and log per capita income in 1970; (5) log population and log per capita income in 1980; (6) log population and log per capita income in 1991; (7) an index of transportation costs to the nearest capital (an alternative measure of distance to central cities) interacted with the four state levels above and the log number of inspectors per firm in the state (baseline specification). This specification is the baseline model as reported in tables 3 and 4. To this specification we then add separately (8) interactions between a measure of state inequality (captured with the variance of the log per capita GDP across cities in each state) with the three distance measures we consider (distance to the nearest enforcement office, distance to the state capital, and an index of transportation costs to the nearest capital); (9) interactions between the log number of beneficiaries of *Bolsa Familia* in the state in 2004, with the three distance measures we consider; (10) interactions between the proportion of municipalities in PETI in the state in 2000, with the three distance measures we consider.

The results of table 3 and 4 are robust across different controls. The only exception refers to the effect of enforcement on wages at the top of the formal wage distribution in table A4, which is negative, but not always statistically significant.

Table A5 in the appendix also replicates table 5 but excluding all early controls for population and GDP in the municipality. The robustness of the results shows that we can safely rely on the cross-sectional variation for the identification of the effects. In addition, we have also

extended the exercise of table 5 to more outcomes. Table A6 in the appendix relates the interaction between distance and scarcity of inspectors to different types of public expenditures, both in 1990 and 2000. This is a way to account for the fact that different municipalities may be offering different public services. With minor exceptions, we do not find systematic differences in patterns of public expenditure across cities with different enforcement.

Our identifying variation comes from the interaction of distance to the nearest enforcement office with a measure of scarcity of inspectors in the state, measured by the log number of inspectors per firm in the state. One may worry whether most of the variation in this measure of scarcity comes from the numerator (number of inspectors in the state) or the denominator (number of formal firms in the state), and in general, what are the main determinants of this variable. We examine these issues in detail and present the results in the appendix. In particular, in table A7 we begin by regressing the log number of inspectors per firm in the state on average GDP and population in the state over the years 1970, 1980, 1990 and 2000, and then we add to the regression the numerator (log number of inspectors) and the denominator (log number of firms) separately. We observe that they have roughly the same contribution to the R-squared of the regression. Therefore, we next examine what happens to our main result when we use alternative denominators, namely GPD in the state, number of workers in the state, and population in the state in 2000. The results are shown in tables A8 and A9 and they are similar to our main results.

Finally, given that there are only 24 clusters one may worry about standard clustering procedures. Tables A10 and A11 show that our results are robust to the wild bootstrap procedure recommended in Cameron, Gelbach and Miller (2008). All coefficients that were statistically significant before remain so, and (perhaps surprisingly) two more become significant.

6. A Simple Theory

In interpreting our findings we consider a simple two sector model of the labor market, drawing on Lewis (1954), Harberger (1962), Harris and Todaro (1970), Fields (1975), MacDonald and Solow (1985), Bulow and Summers (1986) , Maloney (2004), and Levy (2008). There is also an important literature integrating search models and informality, namely Acemoglu (2001), Albrecht, Navarro and Vroman (2006), Bosch (2007), Meghir, Narita and Robin (2010). In our paper we abstract from labor market frictions, central in the latter set of papers, and in much recent work on models of the labor market (Shimer, 2010). They are not needed to understand the mechanism we emphasize, so we proceed with the simpler competitive model in mind. For space constraints we moved the formal model (summarized here) to Appendix C.

The standard view of enforcement of labor regulation is quite different from the one we propose. Labor inspectors are seen as imposing higher costs of employment on formal firms by demanding compliance with costly regulation. As a result there is a shift in employment towards the informal sector. Similarly, if labor inspectors are also able to target informal firms then they will increase the costs of hiring informal workers, leading to a decrease in informal employment and wages. Both views are at odds with the data. Therefore, we need a different model.

We have argued above that in Brazil labor inspectors tend to enforce mandated benefits that are valuable to workers. When developing our model, the goal is thus to understand the implications of an increase in mandated benefits in the formal sector (resulting from stricter enforcement of these benefits) on employment and wages in the formal and informal sectors. In a simple competitive model with no rigidities we expect some pass through of benefits to formal wages. The effects on formal and informal employment depend on the rate of pass through. It is

possible that there are no effects on employment if formal wages fully adjust to reflect the cost of these benefits to employers.

In such a simple model, the rate of pass trough will depend on the valuation of benefits by the employees. The model has ambiguous predictions with regard to the effect of enforcement on employment and wages in each sector, which depend on this valuation. A central non-standard aspect of severance pay in Brazil is that employees may value contributions to the severance pay fund more than it costs employers to make these contributions, because firms pay taxes on profits but workers do not pay taxes on severance payments. This implies that for each Real the worker receives as severance pay (net of taxes) the firm needs to disburse less than one Real. If we enlarge the potential set of mandated benefits to health and safety, which are also being potentially enforced with stricter inspections in our data, then the costs of providing better health and safety conditions on the job may also be below the value workers place on them. Workers and firms may fail to coordinate on an efficient solution, if firms cannot perfectly commit to severance payments.

Under these conditions, the formal sector becomes more attractive and we would expect the supply of formal workers to increase, and the supply of workers to the informal sector to decline. As a result, there would be a decline in formal sector wages, an increase in formal sector employment, an increase in informal wages, and a decline in informal employment. We would also expect a rise in total employment since jobs in both sectors are more attractive.

In sum, the general model yields ambiguous predictions regarding informal employment. The central parameter in this model is the valuation of benefits by employees. There are at least two important aspects to add to this simple framework. First, suppose there are minimum wages in the formal sector so that formal wages cannot fully adjust downward. Jobs become rationed in

the formal sector if minimum wages are binding, so assume workers can choose to be informal or to search for a job in the formal sector (or be unemployed). Formal wages will not decline in this case, so they cannot offset the value of mandated benefits, and the attractiveness of formal sector jobs increases. What adjusts to offset the value of mandated benefits is the unemployment rate among workers searching for a formal sector job. Empirically, we expect some of this to be true at the bottom but not at the top of the formal wage distribution.

An additional aspect to consider is the distinction between informal self-employed and informal wage earners. One view is to consider informal wage earners as working (mainly) in a segmented sector, as in a very standard model of the informal sector, and informal self-employed as being mobile between the formal and informal sectors of the economy (e.g., Bosch and Maloney, 2010). Although reality is unlikely to be so extreme, we find some support for this view in our empirical work, so it is the one we adopt in interpreting it. [27]

This is not the only model that would predict that enforcement of mandated benefits reduce informality. Any model where benefits in the formal sector increase, and wages and unemployment do not adjust fully so that informal workers have no incentive to move to the formal sector will have a similar prediction. One may want, for example, to consider a model with search frictions. However, the frictionless model we consider provides us with the essential intuition for this problem.

6.1. Interpretation of Empirical Findings

Our results can be interpreted in light of the arguments just sketched. But which model is the relevant one, the one with or the one without wage rigidity? Although there is no

[27] We could have considered self employed and workers "without a carteira de trabalho" in the same category (and our main messages would hold), but we believe provides a more transparent presentation of the results. Even though they are mostly informal, many self-employed workers (especially at the top of the wage distribution) are very highly skilled and have occupations such as lawyers, engineers, accountants, doctors, among many others.

heterogeneity in the models presented above, it surely exists in the data. Therefore, it seems reasonable to assume that there is some rigidity at the bottom of the wage distribution, but perhaps not at the top. Not only is this statement sensible, it is also supported by the data.

We observe than an increase in the enforcement of mandated benefits in the formal sector leads to a reduction in formal wages, and an increase in formal sector employment. These two results together suggest that it is likely that workers put a higher value on mandated benefits than firms do ($v>1$ in the appendix), at least in the model with no binding minimum wage. Otherwise, ($v\leq 1$) formal wages would still decline, but formal sector employment would not rise.

The reason is the following. If the cost of mandated benefits to the firm is below the value they have to workers (e.g., tax-free job severance payments, health and safety on the job), then an increase in mandated benefits leads to a rise in formal sector employment, if wages are flexible. Labor supply would expand in the formal sector since this sector becomes more attractive, and labor demand would also increase if there was a large decline in wages.

However, there could be some wage rigidity. The minimum wage may prevent formal wages from falling at the bottom of the wage distribution. This would explain the lack of response to enforcement that we observe at the bottom of the formal wage distribution.

If employment expands in the formal sector, then where do the new workers come from? Empirically, we observe a reduction in self-employment, which makes sense under the interpretation that there is possible mobility between self and formal employment. The contraction in the supply of self-employed workers causes an increase in their wages.

Formal sector employment could also increase due to worker registration (through direct action of labor inspectors targeting informal contracts, or indirectly through a deterrent effect). In that case we would expect lower formal sector wages, resulting in an increase in labor supply in

this sector. We would also have to observe a fall in informal and self-employment. Both the decline in formal wages and the reduction in informal employment are at odds with the data.

There is an increase in the share of individuals who are non-employed which could be attributed to downward wage rigidity. As mentioned above, at the bottom of the formal wage distribution wages do not adjust, so some employees are dismissed. Furthermore, self-employed workers are being induced to search for work in the formal sector, in spite of a higher risk of unemployment, because formal sector jobs are made more attractive by the fact that the fall in wages is smaller than the increase in the value of other formal job benefits (because of wage rigidity, or because the value which workers put on benefits is higher than their cost to the firm).

Finally, it is interesting to notice that there are no statistically significant effects on the employment of informal wage earners, and there are only changes at the top of their wage distribution. One hypothesis is that they are part of a segmented branch of the labor market in Brazil, mainly shielded from changes in the labor market (except, perhaps, for high earners).[28]

Up to now, we have ignored corruption. However, in the real world, increased enforcement may indicate more frequent corruption opportunities, especially for firms breaking the law. One way to model this is to consider an increase in the costs of hiring either formal or informal workers. Nevertheless, corruption by itself cannot explain our data since it would imply a decline in wages in both sectors, and possibly a decline in employment in both sectors (because of higher labor costs).

[28] It is instructive to compare wages of formal, informal, and self-employed workers. Using data from the 2000 Census, in figure A4 in the appendix we plot the densities of log monthly wages for each group. Note how the left tail of the self employed wage distribution coincides with the left tail of the informal wage distribution, and the right tail of the self-employed wage distribution coincides with the right tail of the formal wage distribution. Based on wages alone, self-employed workers are in between formal and informal employees. Figure A5 plots the density of years of education for each of these three groups and for those who are non-employed. Self-employed workers are the least educated among the four groups considered in this figure. Based on wages alone it seems that self-employment is a better substitute for formal employment than informal employment, but the reason for this is not a similarity in years of education between self-employed and formal workers.

7. Conclusion

In this paper we present a new analysis of labor markets in developing countries, which emphasizes the role of weak enforcement of labor market regulation. We use data from Brazil, a country where informality is common, and labor law is strict but weakly enforcement.

We find that stricter enforcement leads to an increase in formal sector employment and non-employment, and a decrease in employment in the informal sector, most of which seems to be due to a reduction in self-employment (rather than a reduction in the proportion of informal wage earners in the economy).

We also find that earnings fall at the top of the formal wage distribution, and they rise across the distribution of earnings among the self-employed. There may also be some increase in the wages of informal employees, but that result is weaker and less robust than the results for formal and self-employed earnings.

If labor inspectors are mainly targeting informal firms and informal workers, then inspections would increase the cost of using informal employment (negative shock to the demand for informal workers). In this case we would expect a decrease in informal sector employment and wages, which is at odds with the data.

Alternatively, suppose labor inspectors target mainly formal firms, enforcing compliance with costly regulations. In this scenario, the increase in labor costs occurs in the formal sector, and as a result we would expect a decline in formal employment and a decline in formal wages, which is also at odds with the data.

The model we propose assumes that labor inspectors target formal firms, but that they enforce compliance with regulations which are highly valued by workers. In fact, a recent detailed study of labor inspections in Brazil (Cardoso and Lage, 2007), argues that enforcement

affects mainly the compliance with mandated benefits in the formal sector. This model generates predictions broadly consistent with our findings: a decline in formal earnings, an increase in formal employment, an increase in informal earnings, and an increase in informal employment.

The addition of minimum wages to this model further improves the agreement of its predictions and our empirical results. At the top of the formal wage distribution, workers bear the cost of mandated benefits by receiving lower wages. But wage rigidity (due, say, to the minimum wage) prevents this downward adjustment at the bottom of the income distribution. As a result, formal sector jobs at the bottom of the wage distribution become more attractive, inducing low skilled workers to search for formal jobs, resulting in lower levels of informality. Because of minimum wages, non-employment may also increase.

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Figure 1: Effect of Distance on Inspections per Firm in the City Across Brazilian States

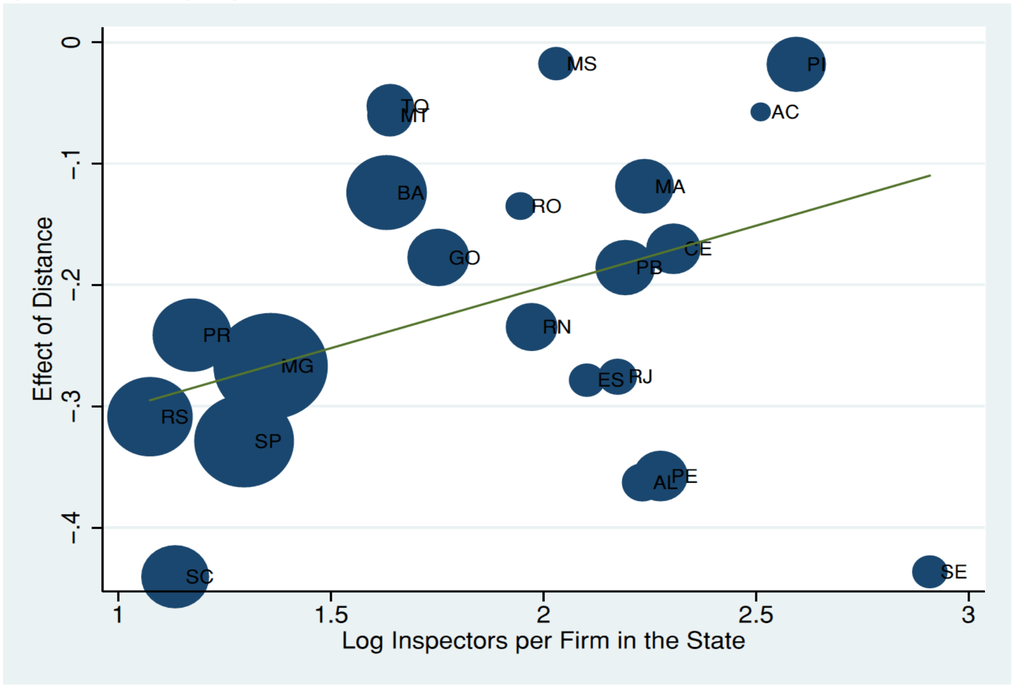


Figure 2: Effect of Distance on the Share of Informal Workers in the City Across Brazilian States

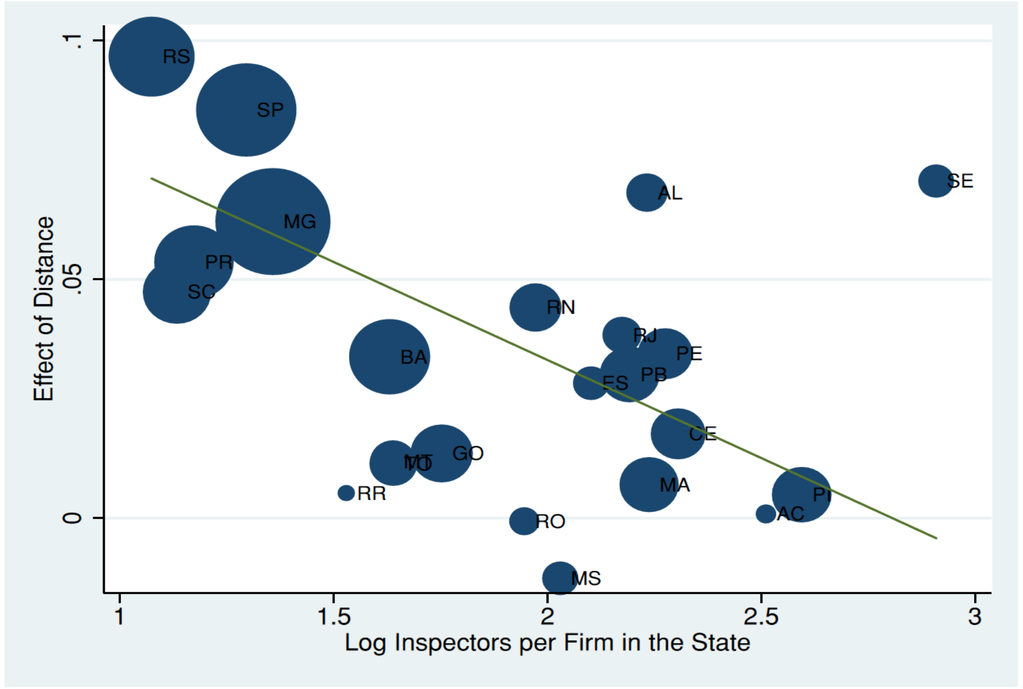
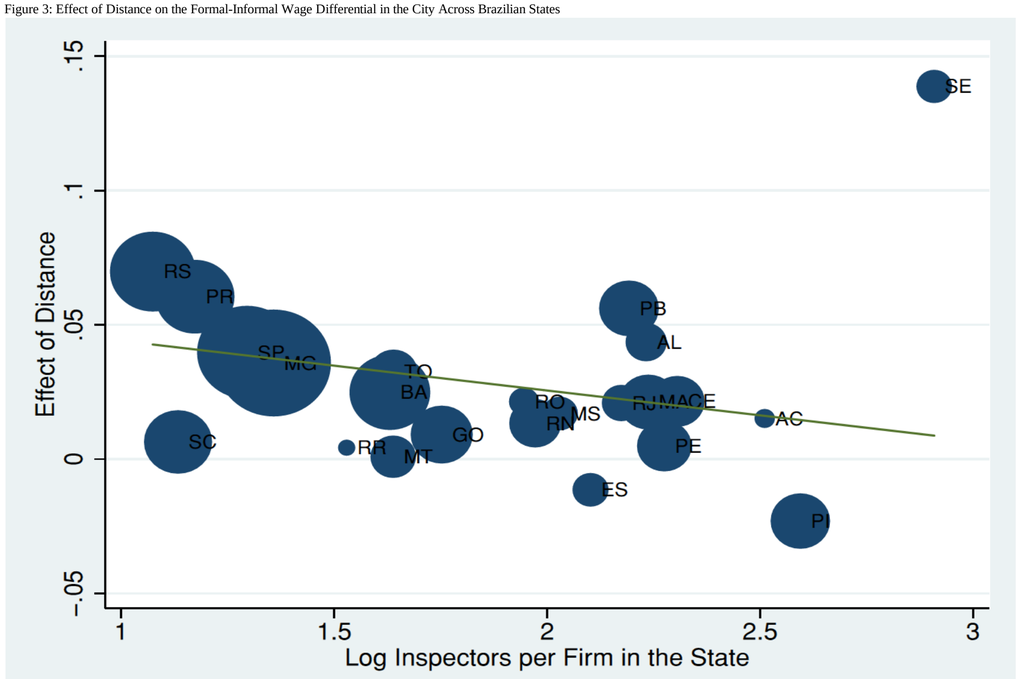


Figure 3: Effect of Distance on the Formal-Informal Wage Differential in the City Across Brazilian States



Note: In Figure 1 we run, for each Brazilian state, a regression of the degree of enforcement (measured by the log of number of inspections per firm in the city in 2002) on distance to the nearest enforcement office (measured in hours of travel by car). Each circle represents a coefficient of one of these regressions, which is plotted against the log number of inspectors per firm in the state (coeff. = 0.101, s.e. = 0.046) . The size of each circle is the number of cities in each state. Figures 2 and 3 can be interpreted analogously. Figure 2 plots the coefficients of a regression of the share of informal workers (in 2000) in each city on distance, against the log number of inspectors per firm in the state (coeff. = -0.041, s.e. = 0.010), while Figure 3 plots the coefficients of a regression of the formal-informal wage differential at the city level (in 2000) on distance, against the log number of inspectors per firm in the state (coeff. = -0.019, s.e. = 0.011).

Table 1: Summary Statistics

Number of Observations	5242
Share Population Non-Employed in 2000	0.37
	(0.0931)
Share Population Formal Jobs in 2000	0.14
	(0.0940)
Share Population Informal Jobs in 2000	0.16
	(0.0643)
Share Population Self-Employed in 2000	0.19
	(0.0897)
Monthly wages in formal sector in 2000	396.34
	(150.57)
Monthly wages in informal sector in 2000	335.73
	(149.15)
Monthly wages self-employed in 2000	474.22
	(276.10)
Share Population Non-Employed in 1980	0.42
	(0.0516)
Share Population Formal Jobs in 1980	0.15
	(0.1092)
Share Population Informal Jobs in 1980	0.14
	(0.0899)
Share Population Self-Employed in 1980	0.25
	(0.1154)
Monthly wages in formal sector in 1980	507.67
	(166.31)
Monthly wages in informal sector in 1980	278.26
	(88.10)
Monthly wages self-employed in 1980	494.38
	(241.12)
Number of Inspections per 100 Firms per firm City in 2002	3.24
	(5.9339)
Proportion of Workers Targeted by Inspections in 2002	0.22
	(3.5263)
Inspectors per 10000 Firms in the state in 2002	5.88
	(3.2744)
Distance to the nearest labor office (hours)	1.96
	(1.7124)
City distance to the State capital city (hours)	4.50
	(2.5476)
GDP per capita City in 2000	4537.15
	(5865.23)
Population City in 2000	26951.00
	(160814)
Area of the City in Km2 in 2000	1048.38
	(2603.93)
Share GDP Agriculture in 2000	0.29
	(0.1842)
Share GDP Manufacturing in 2000	0.20
	(0.1713)
Share GDP Services in 2000	0.51
	(0.1533)

Source: Brazilian Ministry of Labor (2002), Population census (2000), IPEA, IBGE. 2000 values are in 2000 Reais, 1980 values are in 1980 Cruzeiros. For some of these variables there are slightly less of 5242 non-missing observations.

Table 2: The Determinants of Labor Inspections

Dependent Variable:	Log Inspections per Firm in the City	Log Proportion of Inspected Workers in the City
	(1)	(2)
Average Marginal Effect of Distance to the nearest labor office	-0.1	-0.22
	[0.020]***	[0.04]***
Distance to the nearest labor office (hours) * Inspectors per firm in the state	0.212	0.612
	[0.100]**	[0.186]***
Observations	5,242	5,242
R squared	0.35	0.40

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the log of the number of inspections per firm in the city and the log of the proportion of inspected workers in the city on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. The table reports both the coefficient on the interaction of distance and inspectors per firm in the state, and the average marginal effect of distance on enforcement. Variables described in the appendix.

Table 3: Enforcement of Labor Regulations and the Composition of Employment in the City

	Formal Wage Earners	Informal Wage Earners	Self Employed	Non-Employed
	(1)	(2)	(3)	(4)
			Panel A: Baseline Specification	
Distance to the nearest labor office (hours) *	0.016	0.004	-0.023	0.017
* Inspectors per firm in the state	[0.005]***	[0.005]	[0.007]***	[0.006]***
R-Squared	0.67	0.39	0.42	0.36
Observations	5,242	5,242	5,242	5,242
			Panel B: Include 1980 Variables	
Distance to the nearest labor office (hours) *	0.013	-0.001	-0.011	0.014
* Inspectors per firm in the state	[0.005]***	[0.005]	[0.006]*	[0.005]**
1980 Share in Sector	0.301	0.222	0.345	0.428
	[0.045]***	[0.036]***	[0.051]***	[0.056]***
R-Squared	0.7	0.44	0.49	0.4
Observations	5,242	5,242	5,242	5,242

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the log of the proportion of individuals in each sector in the city on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Table 4: Enforcement of Labor Regulations and Wage Distribution, by Employment Status

	Formal Wage Earners			Informal Wage Earners			Self Employed		
	P10	P50	P90	P10	P50	P90	P10	P50	P90
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Baseline Specification									
Distance to the nearest labor office (hours) *	0.024	-0.012	-0.049	0.018	0.017	0.036	0.06	0.063	0.043
* Inspectors per firm in the state	[0.016]	[0.014]	[0.027]*	[0.032]	[0.020]	[0.017]*	[0.025]**	[0.017]***	[0.018]**
R-Squared	0.52	0.61	0.4	0.58	0.76	0.67	0.72	0.79	0.7
Observations	5,232	5,232	5,232	5,242	5,242	5,242	5,241	5,241	5,241
Panel B: Include 1980 Variables									
Distance to the nearest labor office (hours) *	0.019	-0.016	-0.054	0.018	0.016	0.032	0.064	0.056	0.033
* Inspectors per firm in the state	[0.016]	[0.014]	[0.025]**	[0.032]	[0.020]	[0.017]*	[0.025]**	[0.017]***	[0.019]*
R-Squared	0.52	0.61	0.40	0.58	0.76	0.67	0.73	0.80	0.71
Observations	5,232	5,232	5,232	5,242	5,242	5,242	5,241	5,241	5,241

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the percentiles of the distribution of wages for workers in each sector in the city on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Table 5: Other City Characteristics and Alternative Mechanisms

	N. Obs	Distance to the nearest labor office (hours) * Inspectors per firm in the state
	(1)	(2)
Log GDP pc City	5,242	0.012
		[0.047]
Share Agriculture in GDP City	5,228	-0.012
		[0.009]
Share Manufactiring in GDP City	5,242	0
		[0.014]
Share Services in GDP City	5,242	0.012
		[0.017]
Log Population City	5,242	0.007
		[0.091]
Access to Justice City	5,242	0.006
		[0.053]
Managerial Capacity City	5,241	-0.017
		[0.035]
Political Concentration City	5,241	-0.006
		[0.006]
Households Piped Water pc City	5,242	0.062
		[0.057]
Households Sanitation pc City	5,242	0.086
		[0.107]
Households Electricity pc City	5,242	-0.002
		[0.013]
Current Transfers from State to City	4,516	0.07
		[0.080]
Municipality participates in PETI	3,238	0.011
		[0.019]
Number of Participants in Bolsa Familia	5,214	-275.39
		[199.42]

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of each of the variables shown in the lines of the table on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Appendix to the paper Enforcement of Labor Regulation and Informality

July 22nd 2011

Not for Publication

A. Figures and Tables

Figure A1: Effect of Distance on Inspections per Firm in the City Across Brazilian States

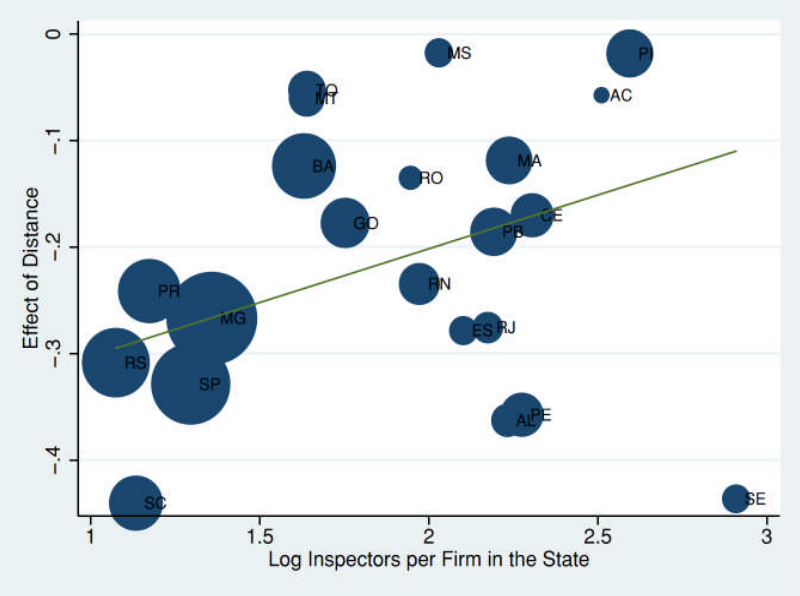


Figure A2: Effect of Distance on the Share of Informal Workers in the City Across Brazilian States

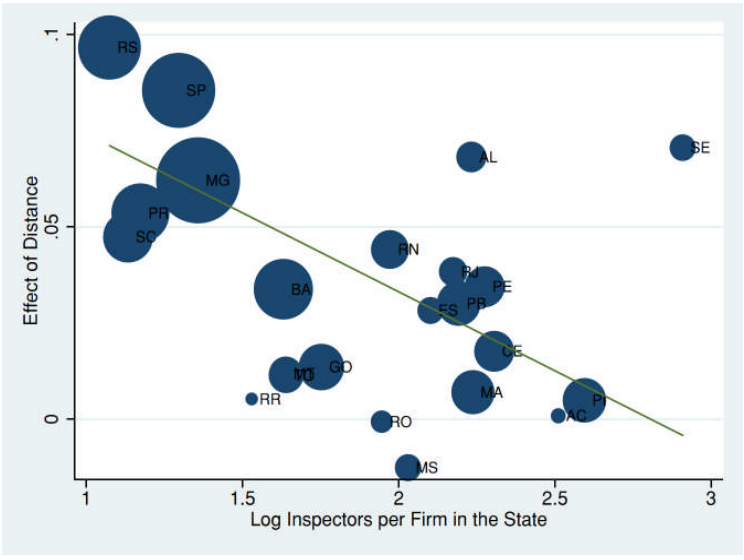
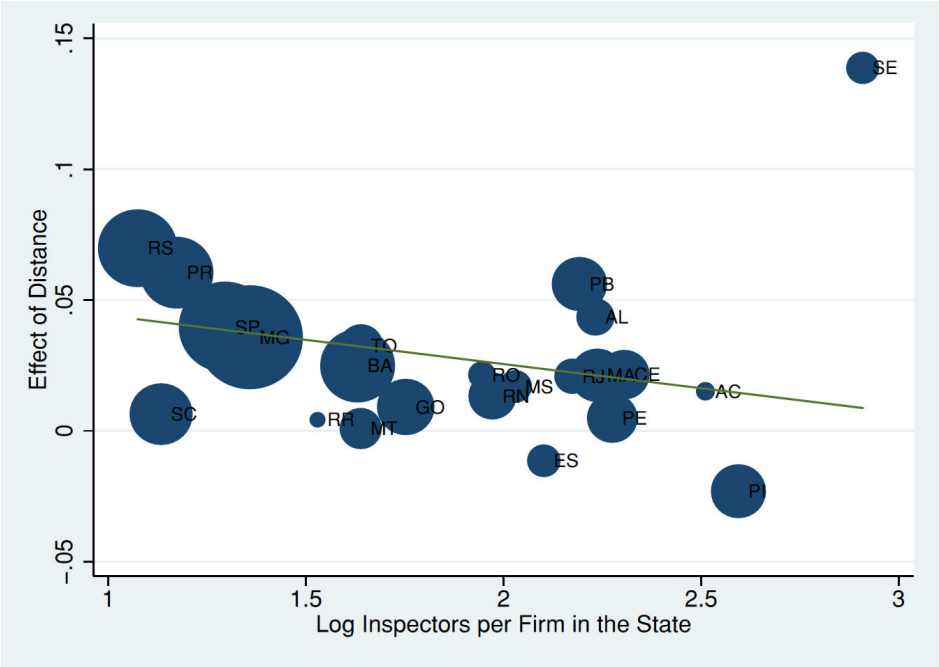


Figure A3: Effect of Distance on the Formal-Informal Wage Differential in the City Across Brazilian States



Note: In Figure A1 we run, for each Brazilian state, a regression of the degree of enforcement (measured by the log of number of inspections per firm in the city in 2002) on distance to the nearest enforcement office (measured in hours of travel by car). Each circle represents a coefficient of one of these regressions, which is plotted against the log number of inspectors per firm in the state (coeff. = 0.101, s.e. = 0.046) . The size of each circle is the number of cities in each state. Figures A2 and A3 can be interpreted analogously. Figure A2 plots the coefficients of a regression of the share of informal workers (in 2000) in each city on distance, against the log number of inspectors per firm in the state (coeff. = -0.041, s.e. = 0.010), while Figure A3 plots the coefficients of a regression of the formal-informal wage differential at the city level (in 2000) on distance, against the log number of inspectors per firm in the state (coeff. = -0.019, s.e. = 0.011).

Figure A4. Log Wages of Formal and Informal Employees, and Self-Employed Workers

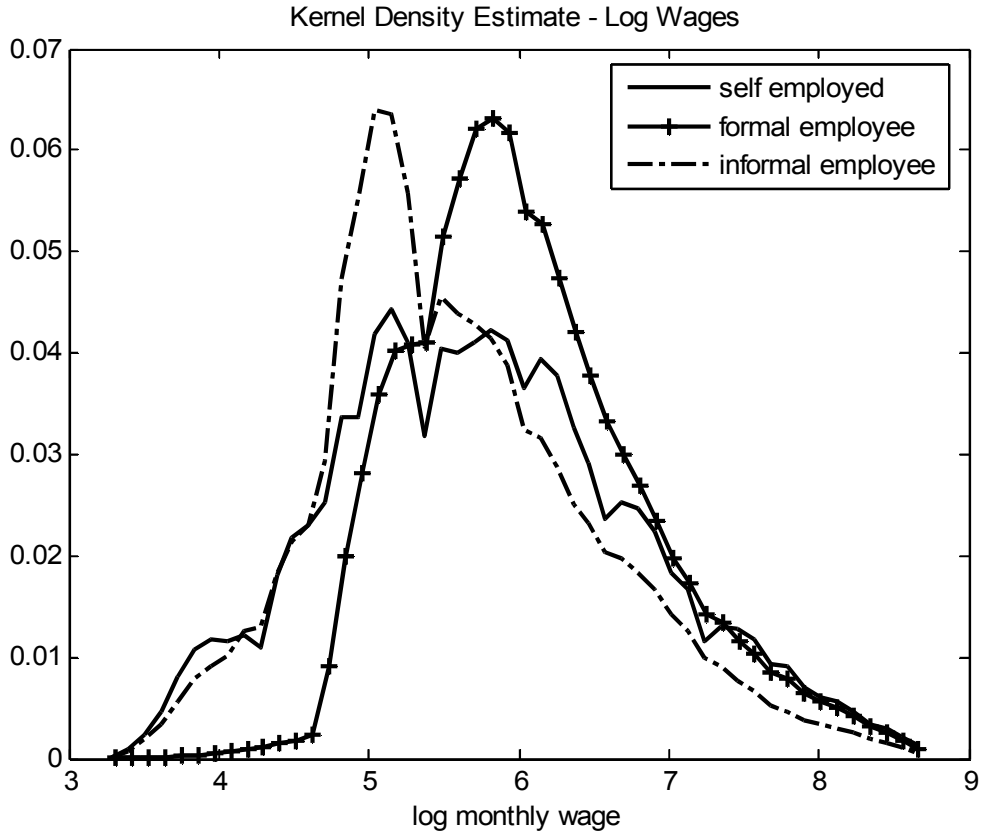


Figure A5. Years of Education of Formal and Informal Employees, Self-Employed Workers, and Non-Employed (or Unemployed) Individuals

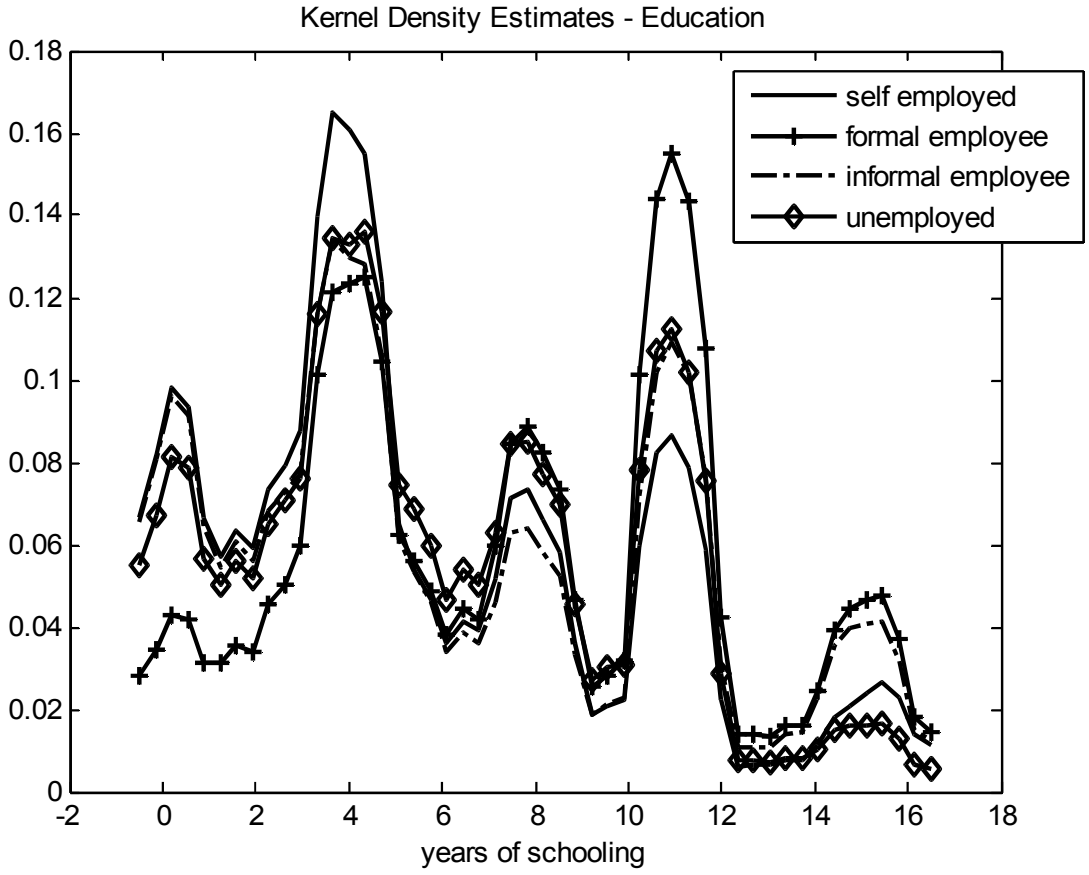


Figure A6. Increase in the Cost of Mandated Benefits Equally Valued by Firms and Workers

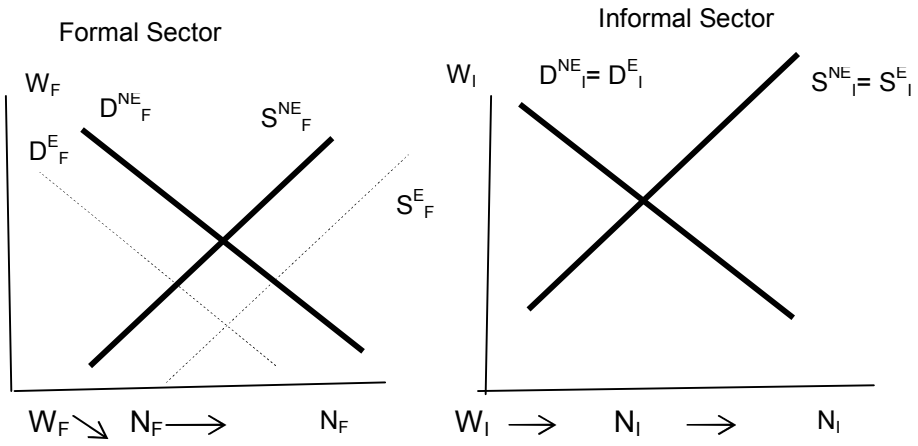


Figure A7. Increase in the Cost of Mandated Benefits Valued More Highly by Workers than Firms

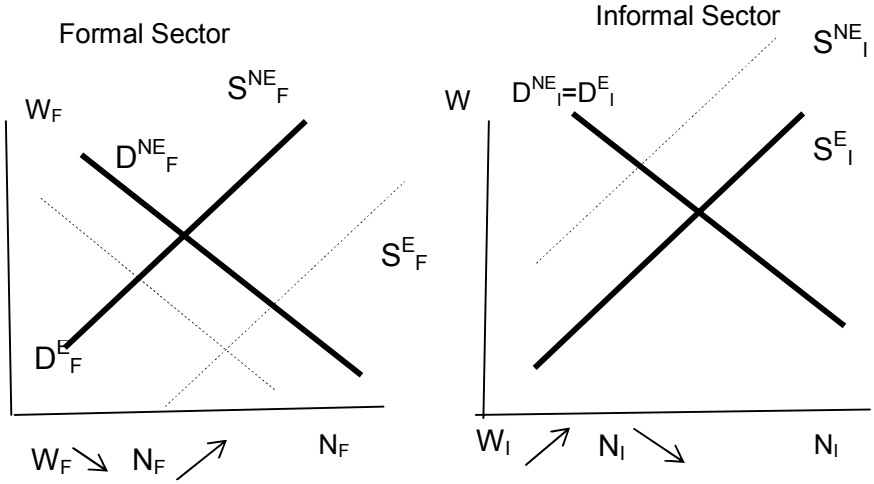
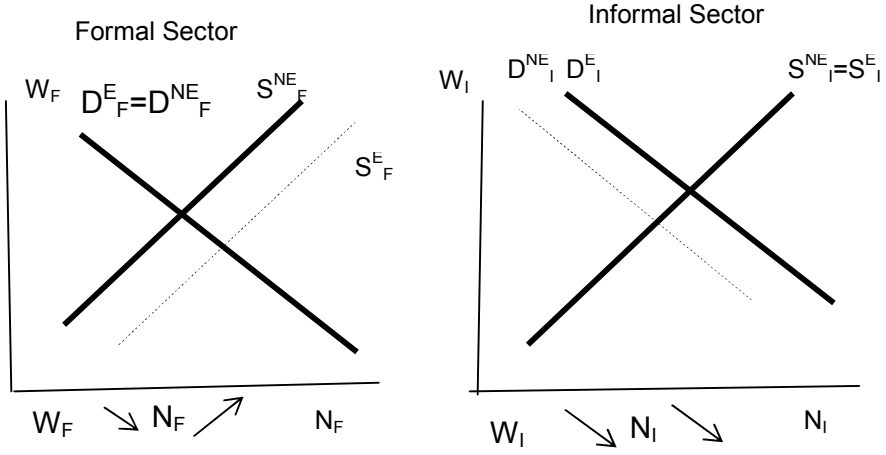


Figure A8. Increase in the Cost of Hiring Informal Workers



B. An Economic Model of Endogenous Enforcement and Labor Market Outcomes

This appendix presents a simple model of endogenous enforcement and labor market outcomes that justifies our empirical specifications, and the assumptions under which they are valid.

Define v_{cs} as the amount of violations to labor law caught in city c of state s, with $v_{cs} = f(E_{cs}, \varepsilon_{cs})$, where E measures the level of enforcement in the city, and ε includes other factors affecting the number of violations caught in the city. Later, it will be convenient to have a special case where the marginal product of enforcement is allowed to vary across cities according to the level of ε, but in a restrictive way:

$$v_{cs} = f(E_{cs}, \varepsilon_{cs}) = \tilde{f}(E_{cs}) + \phi\varepsilon_{cs}E_{cs} + \varepsilon_{cs} \Rightarrow \frac{\partial f(E_{cs}, \varepsilon_{cs})}{\partial E_{cs}} = \tilde{f}'(E_{cs}) + \phi\varepsilon_{cs}. \qquad (A1)$$

This is a restrictive assumption, but it allows enforcement to be more productive in cities where individuals are more prone to commit labor violations, a possible component of ε. Therefore, we can have selective allocation of enforcement across cities according to its productivity.

In each state the goal is to maximize the number of violations caught in all cities, subject to the amount of enforcement resources available, measured in hours of available enforcement activity (the number of inspectors in the state multiplied by hours of work per inspector). We denote total hours of available enforcement time in the state as H_s. The cost of each unit of enforcement is not uniform across cities and depends on the distance, in hours, to the nearest enforcement office, D_{cs}. In each state the problem of allocating enforcement across cities is:

$$\max_{E_{cs}} V_{cs} = \sum_{c_s} f(E_{cs}, \varepsilon_{cs}) \qquad s.t. \sum_{c_s} E_{cs}D_{cs} = H_s$$

Let λ_s be the multiplier on the constraint (strictly positive if the constraint is binding). λ_s is likely to be a function of H and of the distribution of D and ε in the state. The first order conditions for E are:

$$\frac{\partial f(E_{cs},\varepsilon_{cs})}{\partial E_{cs}} = \lambda_s D_{cs} \Leftrightarrow \frac{1}{D_{cs}} \frac{\partial f(E_{cs},\varepsilon_{cs})}{\partial E_{cs}} = \lambda_s . \qquad (A2)$$

This says that we should equalize the productivity of enforcement per unit of enforcement time in each city. Under the simplifying assumption in A1 we get:

$$\tilde{f}'(E_{cs}) + \phi\varepsilon_{cs} = \lambda_s D_{cs} \Rightarrow E_{cs} = \tilde{f}'^{-1}(\lambda_s D_{cs} - \phi\varepsilon_{cs}). \qquad (A3)$$

Differentiating the first order conditions (for the general case) twice with respect to D and H we can see how the level of enforcement in each city responds to changes in distance and in the endowment of inspection time in the state:

$$\begin{aligned}
&\frac{\partial f(E_{cs},\varepsilon_{cs})}{\partial E_{cs}} = \lambda_s D_{cs} \\
&\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2} \frac{dE_{cs}}{dD_{cs}} = \lambda_s \Rightarrow \frac{dE_{cs}}{dD_{cs}} = \lambda_s \left[\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2} \right]^{-1} \qquad (A4) \\
&\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2} \frac{dE_{cs}}{dH_s} = \frac{d\lambda_s}{dH_s} D_{cs} \Rightarrow \frac{dE_{cs}}{dH_s} = \frac{d\lambda_s}{dH_s} D_{cs} \left[\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2} \right]^{-1} \\
&\frac{d^2 E_{cs}}{dD_{cs} dH_s} = \frac{d\lambda_s}{dH_s} \left[\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2} \right]^{-1} - \lambda_s \left[\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2} \right]^{-2} \frac{\partial^3 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^3} \frac{dE_{cs}}{dH_s}.
\end{aligned}$$

We can sign some of these derivatives but not all. If the second order conditions are satisfied them $\partial^2 f(E_{cs},\varepsilon_{cs})/\partial {E_{cs}}^2 < 0$ (declining marginal product of enforcement). In this case, it is simple to show that $d\lambda_s / dH_s < 0$ (the marginal value of each unit H of in the state declines with H). This means that $dE_{cs} / dD_{cs} < 0$ and $dE_{cs} / dH_s > 0$. Curiously, it is not possible to sign $d^2 E_{cs} / dD_{cs} dH_s$, unless $\partial^3 f(E_{cs},\varepsilon_{cs})/\partial {E_{cs}}^3 \le 0$, in which case $d^2 E_{cs} / dD_{cs} dH_s > 0$.

Going back to equation (A3), we could approximate $\widetilde{f}'^{-1}(\lambda_s D_{cs} - \phi\varepsilon_{cs})$ with a first order Taylor's series expansion around $\left(\lambda_s{}^0 D_{cs}{}^0 - \phi\varepsilon_{cs}{}^0\right)$ and get:

$E_{cs} = \widetilde{f}'^{-1}(\lambda_s D_{cs} - \phi\varepsilon_{cs}) = \widetilde{f}'^{-1}\left(\lambda_s{}^0 D_{cs}{}^0 - \phi\varepsilon_{cs}{}^0\right) + \widetilde{f}''^{-1}\left(\lambda_s{}^0 D_{cs}{}^0 - \phi\varepsilon_{cs}{}^0\right)\left(\lambda_s D_{cs} - \phi\varepsilon_{cs} - \lambda_s{}^0 D_{cs}{}^0 + \phi\varepsilon_{cs}{}^0\right)$.
Suppose also that $\varepsilon_{cs} = \delta D_{cs} + \eta_s + \widetilde{\varepsilon}_{cs}$, where δD_{cs} is a distance effect, η_s is a state fixed effect, and $\widetilde{\varepsilon}_{cs}$ is a residual orthogonal to both distance and the state fixed effect. This allows the productivity of inspections to depend on distance and state characteristics through unobservables. We can write the above model for enforcement as the following regression: $E_{cs} = \alpha_0 + \alpha_1 \lambda_s D_{cs} + \alpha_2 D_{cs} + \alpha_{3s} + \widetilde{\varepsilon}_{cs}$, where α_{3s} is a state fixed effect. Finally, we let λ_s be a function of several state variables, including the number of inspectors per firm in the state, state per capita GDP averaged between 1970, 1980 and 2000, and measures of the quality of state institutions. This gives rise to the enforcement regression we estimate in the paper. Given the results above, suggesting that λ_s also depends on the dispersion of some city level variables, in tables A5, A6 and A7 in the appendix we also allow λ_s to depend on the variance of per capita GDP in the state (across cities, weighting each city proportional to population), averaged across 1970, 1980 and 2000. The results are almost the same as in the main specification.

We can now turn to the outcome equation. Imagine a reduced form model for labor market outcomes. Let y denote a particular labor market outcome of interest (say, the proportion of formal workers in the city), which is a function of enforcement (E) and other factors (ω): $y_{cs} = g(E_{cs}, \omega_{cs})$. Then, from (A4):

$$\frac{\partial g(E_{cs},\omega_{cs})}{\partial D_{cs}} = \frac{\partial g(E_{cs},\omega_{cs})}{\partial E_{cs}}\frac{\partial E_{cs}}{\partial D_{cs}} = \frac{\partial g(E_{cs},\omega_{cs})}{\partial E_{cs}}\lambda_s\left[\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2}\right]^{-1}$$

$$\frac{\partial g(E_{cs},\omega_{cs})}{\partial H_s} = \frac{\partial g(E_{cs},\omega_{cs})}{\partial E_{cs}}\frac{dE_{cs}}{dH_s} = \frac{\partial g(E_{cs},\omega_{cs})}{\partial E_{cs}}\frac{d\lambda_s}{dH_s}D_{cs}\left[\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2}\right]^{-1}$$

$$\frac{\partial^2 g(E_{cs},\omega_{cs})}{\partial D_{cs}\partial H_s} = \frac{\partial g(E_{cs},\omega_{cs})}{\partial E_{cs}}\frac{d^2E_{cs}}{dD_{cs}dH_s} + \frac{\partial^2 g(E_{cs},\omega_{cs})}{\partial {E_{cs}}^2}\frac{\partial E_{cs}}{\partial D_{cs}}\frac{dE_{cs}}{dH_s},$$

$$where\ \frac{d^2E_{cs}}{dD_{cs}dH_s} = \frac{d\lambda_s}{dH_s}\left[\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2}\right]^{-1} - \lambda_s\left[\frac{\partial^2 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^2}\right]^{-2}\frac{\partial^3 f(E_{cs},\varepsilon_{cs})}{\partial {E_{cs}}^3}\frac{dE_{cs}}{dH_s}.$$

Like before, it is possible to sign the first derivatives (if we know how to sign $d^2E_{cs}/dD_{cs}dH_s$), but not the cross derivative.

If we assume that y is separable in E and ω, and using (A3) in addition, we get: $y_{cs} = g(E_{cs},\omega_{cs}) = \tilde{g}(E_{cs}) + \omega_{cs} = \tilde{g}\left[\tilde{f}'^{-1}(\lambda_s D_{cs} - \phi\varepsilon_{cs})\right] + \omega_{cs}$. Again, doing a series expansion:

$$\tilde{g}\left[\tilde{f}'^{-1}(\lambda_s D_{cs} - \phi\varepsilon_{cs})\right] = h(\lambda_s D_{cs} - \phi\varepsilon_{cs}) = h'\left({\lambda_s}^0 {D_{cs}}^0 - \phi{\varepsilon_{cs}}^0\right) + h'\left({\lambda_s}^0 {D_{cs}}^0 - \phi{\varepsilon_{cs}}^0\right)\left(\lambda_s D_{cs} - \phi\varepsilon_{cs} - {\lambda_s}^0 {D_{cs}}^0 + \phi{\varepsilon_{cs}}^0\right)$$

In addition, assume also that $\omega_{cs} = \rho D_{cs} + \tau_s + \tilde{\omega}_{cs}$, where ρD_{cs} is a distance effect, τ_s is a state fixed effect, and $\tilde{\omega}_{cs}$ is a residual orthogonal to both distance and the state fixed effect. This means that we can write the model for y as the following regression: $y_{cs} = \beta_0 + \beta_1\lambda_s D_{cs} + \beta_2 D_{cs} + \beta_{3s} + \tilde{\mu}_{cs}$, where β_{3s} is a state fixed effect and $\tilde{\mu}_{cs} = \tilde{\varepsilon}_{cs} + \tilde{\omega}_{cs}$. This is the model we estimate in the paper.

Therefore, our identification strategy depends on several assumptions, but the crucial ones are that: λ_s may depend on variables other than the ones we include in the regression, but they have to be orthogonal to distance and the remaining unobservables in the model; we can write ε and ω as a (linear) function of distance plus a state fixed effect, and distance does not interact with the state fixed effect. An economic model of enforcement and labor market

outcomes per se does not invalidate this empirical strategy, i.e., our assumptions are not at odds with economics. What is crucial is what we assume on the unobservables of the model.

C. Model

In interpreting our findings we consider a simple two sector model of the labor market, drawing on Lewis (1954), Harberger (1962), Harris and Todaro (1970), Fields (1975), MacDonald and Solow (1985), Bulow and Summers (1986), and Maloney (2004). There is also an important literature integrating search models and informality, namely Acemoglu (2001), Albrecht, Navarro and Vroman (2006), Bosch (2007), Meghir, Narita and Robin (2010). In this section we abstract from labor market frictions, central in the latter set of papers, and in much recent work on models of the labor market (Shimer, 2010). They are not needed to understand the mechanism we emphasize, so we proceed with the simpler competitive model.

Our initial model has a formal and an informal sector, and no minimum wage (which will be introduced later). W_F and W_I denote wages in the formal and informal sectors, respectively. For simplicity, employers can hire formal and informal workers simultaneously. Employers hiring formal workers face taxes T, so the cost of labor is: $W_F + T$. T can translate into benefits for employees (e.g., social security, severance pay, health and safety conditions), and the value of T for formal employees is vT, where $v \geq 0$ (v can be smaller, equal or even larger than 1). It is illegal to operate in the informal sector, and therefore employers face an expected penalty of P per worker employed in that sector (where P is the product of the penalty and the probability of being caught). We focus on the hiring decisions only, and ignore the decision of the firm to be formal or informal.[1] Finally, we consider a (residual) household sector, which absorbs the non-

[1] A firm is generally defined to be formal if it pays taxes (e.g., De Paula and Scheinkman, 2006).

employed population (e.g, individuals who decide not to work because their reservation wage is higher than the market wage in each sector). The total number of individuals in the economy is *N*, who can either work in the formal sector (N_F), work in the informal sector (N_I), or be non-employed (N_H). Labor markets are competitive, and equilibrium wages and quantities of labor in each sector are determined by the intersection of supply and demand. Without an informal sector, we could use the model in Lazear (1990) to analyze the impact of mandated benefits.

We start by modeling an increase in enforcement solely as an increase in *T* since, as explained before, most of enforcement activity in Brazil concerns: i) guaranteeing the payment of contributions to the severance pay fund, as well as compliance with firing rules and payments; ii) health and safety conditions. We represent the labor market with the following equations:

$$\text{Demand for Formal}: D_F = a\text{-}b(W_F + T) + c(W_I + P) \quad (1)$$

$$\text{Demand for Informal}: D_I = e + f(W_F + T) - g(W_I + P) \quad (2)$$

$$\text{Supply of Formal}: N_F = h + i(W_F + vT) - jW_I \quad (3)$$

$$\text{Supply of Informal}: N_I = k - l(W_F + vT) + mW_I \quad (4)$$

$$\text{Equilibrium in Formal}: D_F = N_F \quad (5)$$

$$\text{Equilibrium in Informal}: D_I = N_I \quad (6)$$

$$\text{Resource Constraint}: N_F + N_I + N_H = N \quad (7)$$

It is also possible that enforcement leads to higher costs of hiring informal workers, by making detection more probable, corresponding to an increase in *P*. We examine this later in the paper.

Equations (1) to (4) characterize the demands and supply for each type of labor.[2] *T* and *P* depend directly on enforcement *E*, and for now it will be convenient to define *T=E* and *P=0*. Equations (5) to (7) characterize the equilibrium. With the exception of the intercepts of the equations, it is natural to assume all the parameters are positive (if the two types of labor are substitutes). This formulation is arbitrary, but it is possible to derive demand and supply equations for each labor

[2] In the model, upper case letters represent endogenous variables, except for P and T. Lower case letters represent parameters. P and T are parameters as well, but they will change in our comparative statics exercises.

market from a simple model where individuals maximize utility and firms maximize profits. The assumption of linearity is made just for simplicity.

Differentiating the system above with respect to an increase in enforcement ($T=E$), and denoting derivatives with respect to T as lower case letters:

$$d_F = -b(w_F + 1) + cw_I \quad (8)$$
$$d_I = f(w_F + 1) - gw_I \quad (9)$$
$$n_F = i(w_F + v) - jw_I \quad (10)$$
$$n_I = -l(w_F + v) + mw_I \quad (11)$$
$$d_F = n_F \quad (12)$$
$$d_I = n_I \quad (13)$$
$$n_F + n_I + n_H = 0 \quad (14)$$

The solution to this system is complex. One way to simplify our calculations is to set $c=f=0$ (little or no cross-sector linkages in demand), which is an unrealistic assumption but helps us learn about the mechanics of this system. The solution to equations (8)-(14) in this case is:

$$d_F = \frac{(1-v)b(jl - im - ig)}{(b+i)(g+m) - jl} = n_F \quad (15)$$
$$d_I = \frac{(1-v)lbg}{(b+i)(g+m) - jl} = n_I \quad (16)$$
$$n_H = \frac{(1-v)[bi(g+m) - bl(g+j)]}{(b+i)(g+m) - jl} \quad (17)$$
$$w_F = \frac{vjl - (b+vi)(g+m)}{(b+i)(g+m) - jl} \quad (18)$$
$$w_I = \frac{-(1-v)bl}{(b+i)(g+m) - jl} \quad (19)$$

The denominator in all these expressions is positive if $im-jl>0$, which should happen unless cross effects of wages in the supply equations (i.e, j and l) are very strong (stronger than own effects, i.e., i and m). Below we assume this condition holds, and also that $i>j$. The sign of expressions involving $(1-v)$ depends on whether v is smaller or larger than 1 (i.e., whether the valuation workers place on mandated benefits is smaller or larger than their cost to employers).

Finally if we examine some of the central components in the numerators of the equations above (writing the equation numbers below and the relevant numerator next to it):

$(15): b(jl - im - ig) < 0 \; if \; im > jl$
$(16): lbg > 0$
$(17): bi(g + m) - bl(g + j) > 0 \; if \; im - jl \; and \; i > j$
$(18): vjl - (b + vi)(g + m) < 0 \; if \; im > jl$
$(19): bl > 0.$

This means that:

$d_F, n_F \leq 0 \; if \; v \leq 1; d_F, n_F > 0 \; if \; v > 1$
$d_I, n_I \geq 0 \; if \; v \leq 1; d_I, n_I < 0 \; if \; v > 1$
$n_H : \geq 0 \; if \; v \leq 1; n_H < 0 \; if \; v > 1$
$w_F \leq 0$
$w_I \leq 0 \; if \; v \leq 1; w_I > 0 \; if \; v > 1.$

v plays a central role in the analysis, which can be seen throughout this section. As a result of an increase in enforcement we expect a contraction in the labor demand curve because formal workers become more expensive. We also expect an expansion of the formal labor supply curve, since formal jobs become more attractive. Taking v=1 provides a useful baseline case, in which employers and employees put exactly the same valuation on those benefits mandated by regulation. If there were no wage rigidities, then the equilibrium wage in the formal sector would decrease by an amount equal to the cost of the mandated benefits, with no change in formal employment (Lazear, 1990), and no change in the informal sector. This case is depicted in figure A6 which plots the demand and supply of workers in the formal (D_F and S_F) and informal sectors (D_I and S_I), in economies with and without enforcement (e.g., S^E_F vs. S^{NE}_F). [3]

[3] We assume the absence of asymmetric information between workers and firms, wage rigidity, or credit constraints. In this case mandated benefits that are valued equally by employers and employees are borne by workers in the form of lower wages, and have no effects on employment. While these assumptions may hold at the top of the wage distribution, they are unlikely to be true at the bottom, which can lead us to see some effects of mandated benefits on

Several empirical papers estimate large rates of pass-through from payroll taxes and mandated benefits to wages (e.g., Gruber, 1994, 1997, Marrufo, 2001, Kugler, 2005, Heckman and Pages, 2003).[4] At the bottom of the wage distribution, it is likely that the pass-through rate is below 100%, because of downward wage rigidity due to, say, a minimum wage (we discuss this case below). At the top of the wage distribution, it is possible that it is close to 100%, especially for job severance pay since workers can easily gain access to the job severance fund.

Moreover, it is even plausible that $v>1$ in Brazil (which would imply larger than 100% pass through rates in this model) if: i) firms pay taxes on profits but workers do not pay taxes on severance payments (this is the case in Brazil), which means that for each Real the worker receives as severance pay (net of taxes) the firm needs to disburse less than one Real; ii) the costs of providing better health and safety conditions on the job are below the value workers place on them. This case is shown in figure A7. In this case, we would also expect total employment to increase since jobs in both the formal and informal sectors are more attractive.[5]

Another possibility is that $v<1$. Workers may not be fully informed of their rights to severance pay, and they may perceive the probability of ever using the amount on their severance pay fund to be below 1. Our empirical results will help us discern the most likely scenario.

Assume now that an increase in enforcement translates into an increase in the parameter P (keeping T fixed). [6] In this case, firms are urged to reclassify their informal workers as formal

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employment, as we show below in a model with a minimum wage (e.g., Summers, 1989, Mitchell, 1990, Lazear, 1990).

[4] Heckman and Pages (2003) estimate rates of pass-through close to 90% in OECD countries, while Marrufo (2001) and Kugler (2005) have estimates closer to 60-80% for Mexico and Colombia. Gruber (1994, 1997) stands out for estimating 100% pass-through rates, for the US (maternity benefits) and Chile (payroll taxes).

[5] Recall that, for simplicity, we assume there is no change in the demand for informal labor ($c=f=0$). In a more general model we would expect the equilibrium demand curve for informal labor in an economy with enforcement to the left of the original curve, since the equilibrium cost of formal labor (inclusive of the cost of mandated benefits) is below what it was in an economy without enforcement.

[6] Formally, P is analogous to T, but the analysis is simpler since workers place no value on P. For brevity, we omit the full analysis from the paper, since our focus is on T.

(under the penalty of being fined), and then comply with social security, payroll, or severance payments. Therefore, there will be a contraction in the demand for informal workers. The result would be a shift in employment from the informal to the formal sector, and a decline in wages in both sectors. This is shown in figure A8, although the figure does not allow the full equilibrium effects to take place in the figure (we keep the demand for formal workers and supply of informal workers fixed).[7]

It is also important and realistic to consider a case where there is downward wage rigidity at least in the formal sector, due to the existence of a minimum wage (although there could be other reasons for downward wage rigidity).[8] If the minimum wage is binding, there will be involuntary unemployment in the formal sector, and a queue for formal sector jobs. One simple way to incorporate this in the model is to assume that workers are risk neutral in the sense that they only care about the expected wage in the formal sector (the formal wage times the probability of employment given that one has joined the queue), that they can only queue for a formal sector job if they are unemployed, and that they are selected from the queue at random. This model is reminiscent of Harris and Todaro (1970) and subsequent work.

Assuming that the minimum wage is binding, the main equations for this model are:

[7] In a simple competitive model, enforcement is always distortionary and welfare reducing. More generally, the welfare implications of increases in enforcement are mixed. The standard view is that taxes and mandates impose distortions and reduce welfare. However, if formal jobs are intrinsically more productive than informal jobs, there may be a role for promotion of formality (Acemoglu, 2001), as long as it is not just a pure reclassification of workers doing the same job. Similarly, if workers are credit constrained, benefits such as severance payments may be welfare enhancing (Alvarez and Veracierto, 2001). Several authors consider non-competitive models of the labor market, in which firms have some monopsony power. In these models mandated benefits can increase the bargaining power of workers, allowing them to increase their total compensation package (e.g., Saint-Paul, 1995, Ljunqvist, 2002). As a response, wages of informal workers may increase, keeping them indifferent across sectors.

[8] Based on the evidence discussed in Cardoso and Lage (2007), we assume that an increase in enforcement translates mostly to an increase in the compliance with mandated benefits (through severance pay, health and safety conditions). Those authors do not argue that enforcement translates into additional compliance with the minimum wages and, thus, we do not explore this channel in our model.

$$\text{Demand for Formal}: D_F = a\text{-}b(\overline{W_F} + T) + c(W_I + P) \quad (20)$$

$$\text{Demand for Informal}: D_I = e + f(\overline{W_F} + T) - g(W_I + P) \quad (21)$$

$$\text{Supply of Formal}: N_F = h + i(\overline{W_F} + vT)(1-U) - jW_I \quad (22)$$

$$\text{Supply of Informal}: N_I = k - l(\overline{W_F} + vT)(1-U) + mW_I \quad (23)$$

$$\text{Equilibrium in Formal}: D_F = N_F(1-U) \quad (24)$$

$$\text{Equilibrium in Informal}: D_I = N_I \quad (25)$$

$$\text{Resource Constraint}: N_F + N_I + N_H = N \quad (26)$$

Relatively to the model in equations (1)-(7), $\overline{W_F}$ is the binding minimum wage, N_F is the number of individuals willing to queue for a job in the formal sector, and U is the proportion of such individuals who become formal workers (1-U is the proportion who remain in the queue, and who are unemployed).

As above, assume that there are no cross effects in demand ($c=f=0$) and that own effects of wages on supply are stronger than cross effects ($im-jl>0$, $i-l>0$). Then, differentiating with respect to T, and solving the system (using lower case letters to denote derivatives):

$$d_F = \frac{-N_F b(g+m) - (1-U)(\overline{W_F} + vT)b[jl - i(g+m)]}{N_F(g+m) + (1-U)(\overline{W_F} + vT)[i(g+m) - jl]} < 0 \quad (27)$$

$$n_F = \frac{[b(\overline{W_F} + vT) - vN_F(1-U)][jl - i(g+m)]}{N_F(g+m) + (1-U)(\overline{W_F} + vT)[i(g+m) - jl]} \leq or > 0 \; if \; b(\overline{W_F} + vT) - vN_F(1-U) \geq or < 0 \quad (28)$$

$$d_I = n_I = \frac{[b(\overline{W_F} + vT) - vN_F(1-U)]gl}{N_F(g+m) + (1-U)(\overline{W_F} + vT)[i(g+m) - jl]} \geq or < 0 \; if \; b(\overline{W_F} + vT) - vN_F(1-U) \geq or < 0 \quad (29)$$

$$n_H = \frac{[vN_F(1-U) - b(\overline{W_F} + vT)][jl - im + g(l-i)]}{N_F(g+m) + (1-U)(\overline{W_F} + vT)[i(g+m) - jl]} \geq or < 0 \; if \; b(\overline{W_F} + vT) - vN_F(1-U) \geq or < 0 \quad (30)$$

$$u = \frac{b(g+m) - v(1-U)^2[jl - i(g+m)]}{N_F(g+m) + (1-U)(\overline{W_F} + vT)[i(g+m) - jl]} > 0 \quad (31)$$

$$w_I = \frac{[vN_F(1-U) - b(\overline{W_F} + vT)]l}{N_F(g+m) + (1-U)(\overline{W_F} + vT)[i(g+m) - jl]} \leq or > 0 \; if \; b(\overline{W_F} + vT) - vN_F(1-U) \geq or < 0. \quad (32)$$

The number of workers employed in the formal sector declines. Given that wages are fixed at the minimum wage (assuming that it is binding) and that there is an increase in mandated

benefits, firms want to hire less formal workers. As a result, for a fixed informal wage, there is an increase in the unemployment rate in the formal sector (U). Formal jobs are now more attractive if you are able to get them, but it becomes less likely that someone in the queue for formal jobs is able to start working in the formal sector. The remaining derivatives in the system have an ambiguous sign, which depends on the following partial equilibrium question: if informal wages were kept fixed, would the formal sector be more or less attractive after the increase in enforcement? It is possible to show that the answer to this question depends on the sign of $b\left(\overline{W_F}+vT\right)-vN_F\left(1-U\right)$ (which is crucial for equations 28, 29, 30, and 32), which measures the change in the attractiveness of the formal sector in response to a change in T.[9] If the formal sector becomes more attractive with the additional enforcement then the proportion of workers in the household and informal sectors declines, and the informal wage increases. This is to prevent all informal sector workers from moving to the formal sector. The opposite happens if the formal sector becomes less attractive.[10]

In our empirical work we further divide the informal sector in two sub-sectors: informal wage earners and self-employed. This distinction may be important if, following some authors,

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[9] Suppose that $w_I = 0$ (this would be a partial equilibrium argument). Then the equations of the model are just (15), (17) and (19) with the caveat that $w_I = 0$ (and we will continue to assume that c=0). Taking derivatives and solving for u we get: $u = \dfrac{b + iv\left(1-U\right)^2}{i\left(\overline{W_F}+vT\right)\left(1-U\right)+N_F}$. The attractiveness of the formal sector is measured by the expected wage one faces if one decides to search for a formal job, $\left(\overline{W_F}+vT\right)\left(1-U\right)$, so we ask: what is the sign of $\dfrac{\partial\left(\overline{W_F}+vT\right)\left(1-U\right)}{\partial T} = v\left(1-U\right)-u\left(\overline{W_F}+vT\right)$? Substituting u for the expression above we get that $\dfrac{\partial\left(\overline{W_F}+vT\right)\left(1-U\right)}{\partial T} \geq 0 \; if \; b\left(\overline{W_F}+vT\right)-vN_F\left(1-U\right) \leq 0$. This is the change in the attractiveness of the formal sector as a response to a change in T, if informal wages are kept fixed.

[10] This model assumes that there can be no search in the formal sector while employed in the informal sector. While this is restrictive, we would have similar predictions from a model where it is possible to search while employed in the informal sector, but the probability of a successful search is smaller than if search is done while unemployed.

there is duality within the informal sector (e.g., Fields, 1990, 2005, Maloney, 2004). While it is true that there is a group of informal workers who could be working in the formal sector if that was their choice, there is another group which operates in a segmented labor market, queuing for a formal sector job (as in the more traditional view of the informal sector; e.g., Dickens and Lang, 1985).[11] It is simple to introduce a segmented informal sector into the model we just presented, although not particularly useful for the purposes of our study. Our empirical analysis shows that it is important to separate the self-employed, who may be more likely to be in the integrated formal sector, from informal wage earners, who may be more likely to be in the segmented sector. Informal wage earners are essentially shielded from changes in enforcement, which simplifies the theoretical analysis. Bosch and Maloney (2010) draw a similar conclusion from their recent study of labor markets in Brazil, Argentina and Mexico.

D. Additional References

Alvarez, Fernando and Marcelo Veracierto, 2001. Severance Payments in an Economy with Frictions, Journal of Monetary Economics, 47, pp. 477-498.

Ljungqvist, L., 2002, ”How Do Layoff Costs Affect Employment?” *Economic Journal*, vol. 112.

Saint-Paul, Gilles, 1995, "The High Unemployment Trap", *Quarterly Journal of Economics*, May 1995, CX, 2, 527-550

[11] In the empirical work we are not able to rigorously distinguish between upper and lower tier informal workers. However, there is a suggestion in the literature that informal wage earners belong in the lower tier, while part of self-employed workers are likely to be in the upper tier (e.g., Bosch and Maloney, 2010).

Table A1: City Employment Composition

	Obs.	Share Population
	(1)	(2)
Domestic worker with formal work permit	5,507	0.008
Domestic worker without formal work permit	5,507	0.025
Employee with work permit	5,507	0.137
Employee without work permit	5,507	0.163
Employer	5,507	0.015
Self-Employed	5,507	0.196
Unpaid apprentice	5,507	0.001
Unpaid employee	5,507	0.036
Worker self-consumption	5,507	0.046
No employment status	5,507	0.373

This table shows the proportion of the population in each category using individual data from the 2000 Census. These numbers differ slightly from those in table 1 which are city level averages.

Table A2: Determinants of the Number of Workers per Inspection

Dependent Variable:	Log Inspections per Firm in the City
	(1)
Distance to the nearest labor office (hours) * Inspectors per firm in the state	0.252
	[0.092]**
Observations	3,113
R squared	0.23

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the log of the number of workers per inspected firm in the city on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. The table reports the coefficient on the interaction of distance and inspectors per firm in the state. Variables described in the appendix.

Table A3: Enforcement of Labor Regulations and the Composition of Employment in the City, Robustness to Different Controls

	Formal Wage Earners	Informal Wage Earners	Self Employed	Non-Employed
	(1)	(2)	(3)	(4)
Specification 1	0.013	-0.004	-0.007	-0.001
	[0.005]**	[0.004]	[0.007]	[0.005]
Specification 2	0.017	0.006	-0.021	0.014
	[0.008]**	[0.005]	[0.009]**	[0.006]**
Specification 3	0.012	0.007	-0.023	0.017
	[0.010]	[0.005]	[0.008]***	[0.005]***
Specification 4	0.019	0.005	-0.024	0.016
	[0.009]**	[0.005]	[0.008]***	[0.006]***
Specification 5	0.021	0.004	-0.025	0.016
	[0.008]**	[0.005]	[0.007]***	[0.006]**
Specification 6	0.015	0.004	-0.024	0.019
	[0.005]***	[0.005]	[0.007]***	[0.006]***
Specification 7 - Base Case	0.016	0.004	-0.023	0.017
	[0.005]***	[0.005]	[0.007]***	[0.006]***
Specification 8	0.017	0.005	-0.025	0.017
	[0.005]***	[0.005]	[0.008]***	[0.006]**
Specification 9	0.015	0.005	-0.023	0.017
	[0.004]***	[0.004]	[0.007]***	[0.007]**
Specification 10	0.012	0.005	-0.023	0.017
	[0.006]**	[0.007]	[0.009]**	[0.006]**

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the coefficient of distance to the nearest enforcement office interacted with state inspectors. Dependent variable is the log of the proportion of individuals in each sector in the city . Specification (1) regresses the outcome of interest on distance to the nearest enforcement office and its square, distance to the nearest enforcement office interacted with the log number of inspectors per firm in the state, distance to the state capital and its square, distance to the state capital interacted with the log number of inspectors per firm in the state, and state fixed effects. In the following specifications we add the following groups of variables cumulatively until we reach our final specification reported in panel A of table 3: (2) interactions between the two distance variables mentioned above and the log of the average of per capita GDP in the state between 1970 and 2000, and measures of city level institutions averaged at the state level (access to justice, governance and political concentration); (3) city latitude, longitude, altitude and area; (4) log population and log per capita income in 1970; (5) log population and log per capita income in 1980; (6) log population and log per capita income in 1991; (7) an index of transportation costs to the nearest capital interacted with the four state levels above and the log number of inspectors per firm in the state; (8), we add interactions between an additional state variable, the variance of the log per capita GDP across cities in each state (a measure of state inequality) with the three distance measures we consider (distance to the nearest enforcement office, distance to the state capital, and an index of transportation costs to the nearest capital); (9) we add to (7) interactions between an additional state variable, the log number of beneficiaries of Bolsa Familia in the state in 2004, with the three distance measures we consider; (10) we add to (7) interactions between an additional state variable, the proportion of municipalities in PETI in 2000, with the three distance measures we consider. Variables described in the appendix.

Table A4: Enforcement of Labor Regulations and Wage Distribution, by Employment Status, Robustness to Different Controls

	Formal Wage Earners			Informal Wage Earners			Self Employed		
	P10	P50	P90	P10	P50	P90	P10	P50	P90
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Specification 1	0.009	0.005	0.01	0.015	0.033	0.042	0.044	0.048	0.039
	[0.011]	[0.012]	[0.017]	[0.021]	[0.011]***	[0.013]***	[0.033]	[0.025]*	[0.022]*
Specification 2	0.015	-0.011	-0.056	0.044	0.037	0.046	0.107	0.096	0.066
	[0.021]	[0.022]	[0.023]**	[0.039]	[0.027]	[0.021]**	[0.034]***	[0.033]***	[0.026]**
Specification 3	0.007	-0.02	-0.053	0.015	0.014	0.032	0.071	0.065	0.047
	[0.022]	[0.021]	[0.023]**	[0.049]	[0.030]	[0.025]	[0.054]	[0.050]	[0.040]
Specification 4	0.02	-0.005	-0.035	0.038	0.035	0.056	0.099	0.096	0.082
	[0.018]	[0.015]	[0.018]*	[0.046]	[0.026]	[0.025]**	[0.050]*	[0.045]**	[0.033]**
Specification 5	0.025	0.002	-0.027	0.044	0.044	0.064	0.104	0.102	0.087
	[0.018]	[0.015]	[0.019]	[0.045]	[0.026]	[0.025]**	[0.047]**	[0.042]**	[0.030]***
Specification 6	0.012	-0.019	-0.063	0.019	0.018	0.031	0.069	0.061	0.04
	[0.016]	[0.014]	[0.029]**	[0.033]	[0.019]	[0.017]*	[0.026]**	[0.017]***	[0.020]*
Specification 7 - Base Case	0.024	-0.012	-0.049	0.018	0.017	0.036	0.06	0.063	0.043
	[0.016]	[0.014]	[0.027]*	[0.032]	[0.020]	[0.017]*	[0.025]**	[0.017]***	[0.018]**
Specification 8	0.022	-0.012	-0.046	0.02	0.017	0.036	0.068	0.07	0.045
	[0.015]	[0.013]	[0.025]*	[0.026]	[0.018]	[0.017]*	[0.023]***	[0.015]***	[0.020]**
Specification 9	0.01	-0.017	-0.048	0.01	0.006	0.029	0.055	0.06	0.043
	[0.013]	[0.013]	[0.027]*	[0.028]	[0.012]	[0.016]*	[0.024]**	[0.017]***	[0.015]***
Specification 10	0.013	-0.022	-0.051	0.005	-0.002	0.022	0.074	0.072	0.059
	[0.019]	[0.018]	[0.032]	[0.037]	[0.024]	[0.025]	[0.027]**	[0.021]***	[0.022]**

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the percentiles of the distribution of wages for workers in each sector in the city on several controls.The simplest specification (1) regresses the outcome of interest on distance to the nearest enforcement office and its square, distance to the nearest enforcement office interacted with the log number of inspectors per firm in the state, distance to the state capital and its square, distance to the state capital interacted with the log number of inspectors per firm in the state, and state fixed effects. In the following specifications we add the following groups of variables cumulatively until we reach our final specification: (2) interactions between the two distance variables mentioned above and the log of the average of per capita GDP in the state between 1970 and 2000, and measures of city level institutions averaged at the state level (access to justice, governance and political concentration); (3) city latitude, longitude, altitude and area; (4) log population and log per capita income in 1970; (5) log population and log per capita income in 1980; (6) log population and log per capita income in 1991; (7) an index of transportation costs to the nearest capital interacted with the four state levels above and the log number of inspectors per firm in the state; (8), we add interactions between an additional state variable, the variance of the log per capita GDP across cities in each state (a measure of state inequality) with the three distance measures we consider (distance to the nearest enforcement office, distance to the state capital, and an index of transportation costs to the nearest capital); (9) we add to (7) interactions between an additional state variable, the log number of beneficiaries of Bolsa Familia in the state in 2004, with the three distance measures we consider; (10) we add to (7) interactions between an additional state variable, the proportion of municipalities in PETI in 2000, with the three distance measures we consider. Variables described in the appendix.

Table A5: Other City Characteristics and Alternative Mechanisms, Excluding Past Controls for GDP and Population

	N. Obs	Distance to the nearest labor office (hours) * Inspectors per firm in the state
	(1)	(2)
Log GDP pc City	5242	0.012
		[0.064]
Share Agriculture in GDP City	5228	-0.018
		[0.012]
Share Manufactiring in GDP City	5242	-0.001
		[0.019]
Share Services in GDP City	5242	0.02
		[0.016]
Log Population City	5242	0.024
		[0.086]
Access to Justice City	5242	0.033
		[0.056]
Managerial Capacity City	5241	-0.002
		[0.055]
Political Concentration City	5241	-0.005
		[0.006]
Households Piped Water pc City	5242	-0.002
		[0.055]
Households Sanitation pc City	5242	0.232
		[0.171]
Households Electricity pc City	5242	0.023
		[0.027]
Current Transfers from State to City	4516	0.082
		[0.093]
Municipality participates in PETI	3238	0.014
		[0.019]
Number of Participants in Bolsa Familia	5214	-179.81
		[180.91]

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of each of the variables shown in the lines of the table on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We DO NOT INCLUDE the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Table A6: Enforcement of Labor Regulations and Patterns of Public Expenditures

	Administration and Planning	Social Assistance	Communication	Regional Development	Education	Justice	Health and Sanitation	Transports
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A - Expenditures in 1990								
Distance to the nearest labor office (hours) *	0.049	0.09	0.037	0.011	0.062	-0.064	0.011	-0.009
* Inspectors per firm in the state	[0.077]	[0.073]	[0.033]	[0.017]	[0.058]	[0.030]**	[0.067]	[0.092]
Panel B - Expenditures in 2000								
Distance to the nearest labor office (hours) *	0.118	0.219	-0.042	0.148	0.035	-0.27	0.008	0.146
* Inspectors per firm in the state	[0.119]	[0.100]**	[0.328]	[0.192]	[0.075]	[0.268]	[0.105]	[0.201]

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of each of the log of each type of municipal expenditure in 1990 (Panel A) or in 2000 (Panel B) on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Table A7 - Drivers of Variation in Log Inspectors per Firm in the State

	(1)	(2)	(3)	(4)
Log Inspectors in the State	0.999	-	1.276	-
	[0.067]***		[0.217]***	
Log Number of Firms in the State	-1.035	-	-	-1.34
	[0.072]***			[0.238]***
Av. Log per capita GDP in the State	0.017	-0.401	-0.851	0.597
	[0.071]	[0.167]**	[0.129]***	[0.207]***
Av. Log Population in the State	0.049	-0.175	-1.193	1.147
	[0.101]	[0.077]**	[0.179]***	[0.240]***
Average Distance in State	0.007	-0.111	-0.094	0.024
	[0.014]	[0.068]	[0.042]**	[0.050]
Observations	25	25	25	25
R-squared	0.98	0.37	0.77	0.76

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the log number of inspectors per firm in the state on the log number of inspectors in the state, the log number of firms in the state (both measured in 2000), the average log of per capita GDP in the state over 1970, 1980 and 1990, average of log of population in the state over 1970, 1980 and 1990, and the average distance between each city in the state and the nearest labor office. Variables described in the appendix.

Table A8: Enforcement and Composition of Employment in the City: Robustness to Different Normalizations for Inspectors per State

	Formal Wage Earners	Informal Wage Earners	Self Employed	Non-Employed
	(1)	(2)	(3)	(4)
	Panel A: Normalize by State GDP			
Distance to the nearest labor office (hours) *	0.023	-0.002	-0.026	0.015
* Inspectors per firm in the state	[0.007]***	[0.007]	[0.009]**	[0.007]*
R-Squared	0.67	0.39	0.42	0.35
Observations	5,242	5,242	5,242	5,242
	Panel B: Normalize by State Population			
Distance to the nearest labor office (hours) *	0.018	0.002	-0.026	0.018
* Inspectors per firm in the state	[0.008]**	[0.009]	[0.009]***	[0.008]**
R-Squared	0.67	0.39	0.42	0.36
Observations	5,242	5,242	5,242	5,242
	Panel C: Normalize by State Employment			
Distance to the nearest labor office (hours) *	0.017	0.003	-0.027	0.022
* Inspectors per firm in the state	[0.008]**	[0.007]	[0.008]***	[0.007]***
R-Squared	0.67	0.39	0.42	0.36
Observations	5,242	5,242	5,242	5,242

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the log of the proportion of individuals in each sector in the city on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state normalized by state GDP, state population, and number of workers in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state (normalized by the variables above) and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state (normalized by the variables above)and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Table A9: Enforcement of Labor Regulations and Wage Distribution, by Employment Status, Different Normalizations for Inspectors per State

	Formal Wage Earners			Informal Wage Earners			Self Employed		
	P10	P50	P90	P10	P50	P90	P10	P50	P90
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Normalize by State GDP									
Distance to the nearest labor office (hours) *	0.035	-0.015	-0.063	0.091	0.045	0.047	0.119	0.103	0.056
* Inspectors per firm in the state	[0.021]	[0.016]	[0.030]**	[0.030]***	[0.023]*	[0.024]*	[0.023]***	[0.021]***	[0.029]*
R-Squared	0.52	0.61	0.39	0.58	0.76	0.67	0.72	0.79	0.7
Observations	5,232	5,232	5,232	5,242	5,242	5,242	5,241	5,241	5,241
Panel B: Normalize by State Population									
Distance to the nearest labor office (hours) *	0.046	-0.02	-0.064	0.082	0.031	0.036	0.118	0.102	0.066
* Inspectors per firm in the state	[0.020]**	[0.016]	[0.035]*	[0.032]**	[0.025]	[0.026]	[0.027]***	[0.022]***	[0.028]**
R-Squared	0.52	0.61	0.39	0.58	0.76	0.67	0.72	0.79	0.7
Observations	5,232	5,232	5,232	5,242	5,242	5,242	5,241	5,241	5,241
Panel C: Normalize by State Employment									
Distance to the nearest labor office (hours) *	0.039	-0.02	-0.064	0.061	0.026	0.036	0.101	0.094	0.066
* Inspectors per firm in the state	[0.017]**	[0.015]	[0.031]*	[0.033]*	[0.023]	[0.022]	[0.026]***	[0.019]***	[0.024]**
R-Squared	0.52	0.61	0.39	0.58	0.76	0.67	0.72	0.79	0.7
Observations	5,232	5,232	5,232	5,242	5,242	5,242	5,241	5,241	5,241

Standard errors in brackets clustered at the state level, * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the percentiles of the distribution of wages for workers in each sector in the city on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Table A10: Enforcement of Labor Regulations and the Composition of Employment in the City: Robust Clustering Procedure

	Formal Wage Earners	Informal Wage Earners	Self Employed	Non-Employed
	(1)	(2)	(3)	(4)
			Panel A: Baseline Specification	
Distance to the nearest labor office (hours) *	0.016	0.004	-0.023	0.017
* Inspectors per firm in the state	[0.004]***	[0.224]	[0.004]***	[0.006]***
R-Squared	0.67	0.39	0.42	0.36
Observations	5,242	5,242	5,242	5,242
			Panel B: Include 1980 Variables	
Distance to the nearest labor office (hours) *	0.013	-0.001	-0.011	0.014
* Inspectors per firm in the state	[0.003]***	[0.208]	[0.031]**	[0.005]***
R-Squared	0.7	0.44	0.49	0.4
Observations	5,242	5,242	5,242	5,242

P-values in brackets clustered at the state level, using wild-bootstrap procedure of Cameron, Gelbach and Miller (2008), * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the log of the proportion of individuals in each sector in the city on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Table A11: Enforcement of Labor Regulations and Wage Distribution, by Employment Status, Robust Clustering Procedure (p-values in brackets)

	Formal Wage Earners			Informal Wage Earners			Self Employed		
	P10	P50	P90	P10	P50	P90	P10	P50	P90
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Baseline Specification									
Distance to the nearest labor office (hours) *	0.024	-0.012	-0.049	0.018	0.017	0.036	0.06	0.063	0.043
* Inspectors per firm in the state	[0.023]**	[0.224]	[0.004]***	[0.186]	[0.035]**	[0.001]***	[0.004]***	[0.003]***	[0.006]***
R-Squared	0.52	0.61	0.4	0.58	0.76	0.67	0.72	0.79	0.7
Observations	5232	5232	5232	5242	5242	5242	5241	5241	5241
Panel B: Include 1980 Variables									
Distance to the nearest labor office (hours) *	0.019	-0.016	-0.054	0.018	0.016	0.032	0.064	0.056	0.033
* Inspectors per firm in the state	[0.047]**	[0.087]*	[0.004]***	[0.19]	[0.05]**	[0.001]***	[0.003]***	[0.003]***	[0.025]**
Observations	5232	5232	5232	5242	5242	5242	5241	5241	5241

P-values in brackets clustered at the state level, using wild-bootstrap procedure of Cameron, Gelbach and Miller (2008), * significant at 10%; ** significant at 5%; *** significant at 1%. The table reports the least squares estimates of the regression of the percentiles of the distribution of wages for workers in each sector in the city on the distance to the nearest labor office (hours) interacted with the number of labor inspectors in the state. The controls are state dummies, distance to the nearest labor office, its square (reported in the table) and interactions with state level variables (average access to justice; average political concentration; average management quality in public administration; and the log of GDP per capita in the state averaged across 1970, 1980 and 2000), distance to the state capital city, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, city transportation costs, its square and interactions with the number of inspectors per firm in the state and interactions with other state variables, area of the city, city altitude, city latitude and city longitude. City transportation cost is the transport cost between each city and the nearest capital city in 1995. We also include the log of total population and per capita income in 1970, 1980, and 1991. Variables described in the appendix.

Table A12 - Description of Variables

Variable	Source	Definition
Share Population Non-Employed in 2000	Census 2000	Proportion of the Population Ages 23-65 Non-Employed in the City
Share Population Formal Jobs in 2000	Census 2000	Proportion of the Population Ages 23-65 in Formal Employment in the City
Share Population Informal Jobs in 2000	Census 2000	Proportion of the Population Ages 23-65 in Informal Employment in the City
Share Population Self-Employed in 2000	Census 2000	Proportion of the Population Ages 23-65 Self-Employed in the City
Monthly wages in formal sector in 2000	Census 2000	Average Earnings of Formal Employees in the City
Monthly wages in informal sector in 2000	Census 2000	Average Earnings of Informal Employees in the City
Monthly wages self-employed in 2000	Census 2000	Average Earnings of Self-Employed in the City
Share Population Non-Employed in 1980	Census 1980	Proportion of the Population Ages 23-65 Non-Employed in the City
Share Population Formal Jobs in 1980	Census 1980	Proportion of the Population Ages 23-65 in Formal Employment in the City
Share Population Informal Jobs in 1980	Census 1980	Proportion of the Population Ages 23-65 in Informal Employment in the City
Share Population Self-Employed in 1980	Census 1980	Proportion of the Population Ages 23-65 Self-Employed in the City
Monthly wages in formal sector in 1980	Census 1980	Average Earnings of Formal Employees in the City
Monthly wages in informal sector in 1980	Census 1980	Average Earnings of Informal Employees in the City
Monthly wages self-employed in 1980	Census 1980	Average Earnings of Self-Employed in the City
Number of Inspections per City in 2002	Ministry of Labor	Number of Visits of Labor Inspectors to Each City in 2002
Number of Workers Targeted by Inspections per City in 2002	Ministry of Labor	Number of Workers Covered by Visits of Labor Inspectors to Each City in 2002
Inspectors per state in 2002	Ministry of Labor	Number of Labor Inspectors in Each State in 2002
Distance to the nearest labor office (hours)	BB Auto Seguros	Predicted Hours of Travel by Car between Each City and the City with the Nearest Enforcement Office
City distance to the State capital city (hours)	BB Auto Seguros	Predicted Hours of Travel by Car between Each City and the State Capital
GDP in the City in 1970, 1980, 1991, 2000	IPEA	Total GDP in the City (available in 1970, 1980, 1991 and 2000)
Population City in 1970, 1980, 1991, 2000	IPEA	Total Population in the City (available in 1970, 1980, 1991 and 2000)
Area of the City in Km2 in 2000	IPEA	Areal Covered by the City (in squared kilometers)
Altitude of the City	IPEA	Altitude of the City
Latitude of the City	IPEA	Latitude of the City
Longitude of the City	IPEA	Longitude of the City
Share GDP Agriculture in 2000	IPEA	Proportion of the City's GDP coming from Agriculture
Share GDP Manufacturing in 2000	IPEA	Proportion of the City's GDP coming from Manufacturing
Share GDP Services in 2000	IPEA	Proportion of the City's GDP coming from Services
Transportation Costs to Nearest Capital in 1995	IPEA	Index of Transportation Costs from each City to the Nearest State Capital
Federal Transfers to Each City	IPEA	Transfers from the Federal Government to Each City
Municipal Expenditures (various)	IPEA	Expenditures by the Municipal Government in Different Items
Participation in PETI by the city in 2000	Ministry of Social Development	Whether the Municipality Participates in PETI
Number of Recipients of Bolsa Familia per city in 2004	Ministry of Social Development	Number of Recipients of Bolsa Familia in the Municipality
Number of Firms in the City	IBGE	Number of Firms in the City
Access to Justice in the City	IBGE	Index of Access to Justice in the City
Managerial Capacity in the City	IBGE	Index of Managerial Capacity in the City
Political Concentration in the City	IBGE	Index of Political Concentration in the City